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CROP CERTIFICATION.

NOTES ON OPERATIONS IN 1929–30 SEASON AND CURRENT DEVELOPMENTS.

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DURING the past three years a number of articles have been published in the *Journal* relative to the crop-certification system established by the Department of Agriculture, and to the different branches of the work. Readers will therefore be fairly familiar with the subject, and it will not be necessary to make introductory explanations on the present occasion. The object of this article is to briefly summarize the various certification activities for the season of 1929–30, touching also some consequential points connected with current season's affairs. The accompanying photos, illustrating different stages of rye-grass certification work, will doubtless prove of additional interest to farmers and to others connected with the seed trade.

Seed Wheat.

The demand for certified seed wheat has again exceeded expectations. There has been steady progress in this branch, as indicated by the following figures :—

Table 1.

Season.	Area inspected.	Area passed in the Field.	Quantity purchased and resold after Machine-dressing.	Value.
	Acres.	Acres.	Bushels.	£
1927–28	347	216	3,840	1,439
1928–29	1,856	700	11,682	3,934
1929–30	2,779	640	13,050	4,558

In addition to the figures quoted for the 1929–30 season one firm grew and reta ned for its own sale 3,664 bushels of certified smut-free seed, comprising six varieties. This seed was not purchased by the Department, and therefore does not appear in the returns, but it brings up the total amount certified to 16,714 bushels.

It has been agreed to alter the organization for the 1930–31 season. There will be the usual field and grain inspection, but the Department will not in future purchase and distribute certified seed wheat. Samples and full details of every certified line will be distributed to merchants for their information, and the amount passed will be limited to the probable demand for seed of the several varieties. There will then be an open market, and growers will be in a position to sell where they like, and merchants to select the lines they wish to buy from the samples sent them.

A determined effort will be made to distribute as widely as possible those lines that are smut-free, and such lines will be specially marked. Finally, only those crops will be inspected which originate from certified seed.

Wheat-certification is undertaken in co-operation with the Wheat Research Institute, Christchurch. The Department of Agriculture undertakes all field-work, and the Institute arranges grading and distribution of samples.

Full particulars of the wheat-certification system will be found in the *Journal* for April, 1928.

Potatoes.

A total of 408 applications from potato-growers for certification trial were received during 1929–30, as compared with 180 in the previous season. Applications so far received for the present season indicate another advance, in spite of the fact that owing to the necessity for strict economy applications are now restricted to those lines originating from crops provisionally certified either last season or the season before. Any other lines are allowed entry in the qualification trials, and should they prove of sufficiently high standard they may be entered for certification the following season.

The following figures giving the numbers of entries show the progress that has been made in the last four years: 1927–28, 137 crops; 1928–29, 180 crops; 1929–30, 408 crops; 1930–31, 617 crops (355 for certification trial, 262 for qualification trial).

A full report of the 1929–30 season's operations appeared in the August issue of the *Journal*.

Perennial Rye-grass Seed.

The season of 1929–30 was the first in this branch of certification. The bulk of the seed originated from Hawke's Bay, some from Poverty Bay, and two crops of first harvest seed from Central Otago.

A total of 171 crops were passed in the field, representing 2,297 acres. The 6,111 sacks containing the produce of these areas were branded and sealed in the paddock during threshing. Of this, 851 sacks were sold undressed and 5,260 were received by merchants for machine-dressing, from which 17,052 bushels of machine-dressed seed were obtained.

The figures for Hawke's Bay and Poverty Bay are set out in Table 2, the seed being the produce of pasture five years old or over.

The combined effect of certification and other factors caused a sharp rise in the price of certified perennial rye-grass machine-dressed

FIG. 1. FIELD INSPECTION OF A PERENNIAL RYE-GRASS AREA.

[Photo by E. Bruce Levy.

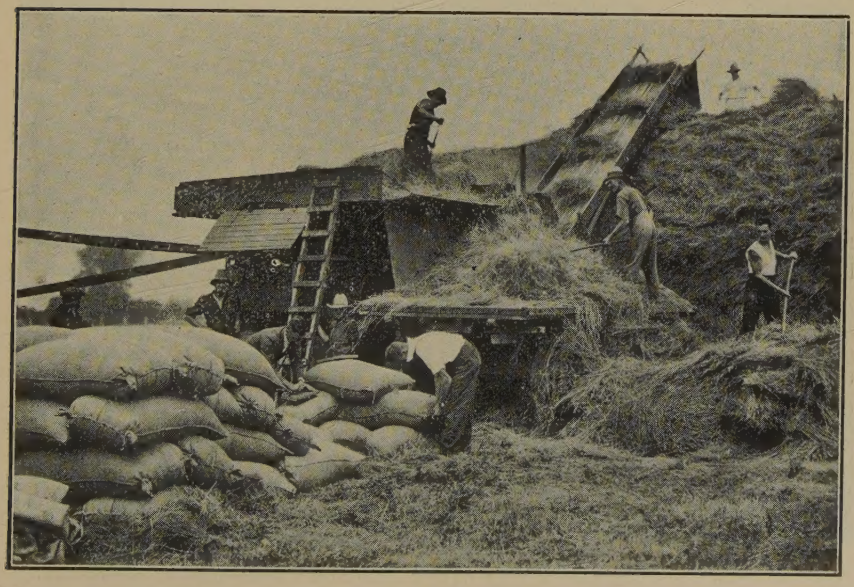

FIG. 2. THRESHING CERTIFIED RYE-GRASS SEED.

The sacks are branded and sealed in the paddock as the seed comes from the mill. The brand enables the line of seed to be identified at the dressing-station, and seals prevent substitution.

[Photo by H. Drake.

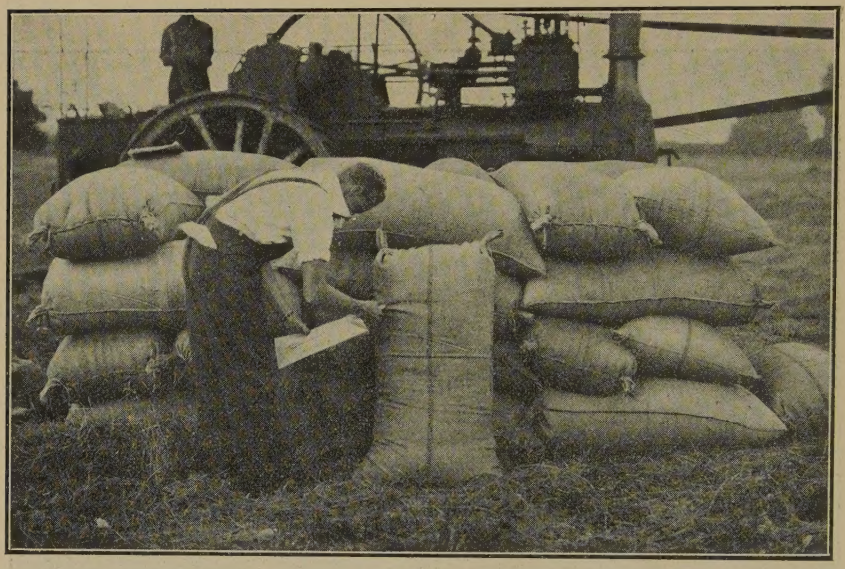

FIG. 3. DRAWING A SAMPLE OF RYE-GRASS SEED IN THE FIELD.

This sample is for trial at the Plant Research Station, where it is sown to determine purity of strain. These trials afford an early check on the accuracy of field inspection.

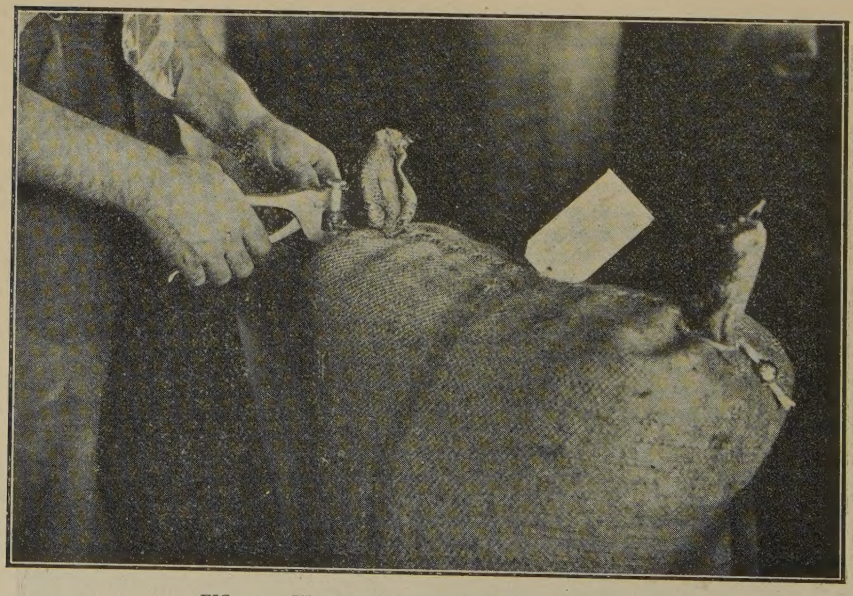

FIG. 4. SEALING AFTER MACHINE DRESSING.

A careful check is made of the weight of seed in and out of the machines during dressing. An insert slip is placed inside the sack, and the seaming twine is threaded through the outside tag during the sewing of the sack. Finally, the ends of the seaming twine are sealed with metal seals at both lugs.

[*Photos by H. Drake.*

Table 2.

District.	Seed sealed in Paddock.	Machine-dressing.			Average Yield per Acre of Undressed Seed.	Average Yield per Acre of Machine-dressed Seed.	Government Statistician: Average Yield per Acre not Machine-dressed.	
		Into Machine.	Out of Machine.	Percentage of Loss in Dressing.			1927–28.	1928–29.
	Bushels.	Bushels.	Bushels.		Bushels.	Bushels.	Bushels.	Bushels.
Hawke's Bay..	34,365	30,405	15,754	48	16·80	8·70	24·15	17·00
Poverty Bay ..	1,925	1,267	736	42	8·70	5·05	6·35	12·25

seed to round about 18s. to 20s. per bushel. This price is considered by graziers to be prohibitive, and in view of the urgent necessity for abundant supplies at reasonable prices growers in seed-producing districts have been encouraged to purchase certified seed, sow this, and enter their crops for certification. It is therefore interesting to note the distribution (up to date of writing) of the seed certified last season, as follows:—

District.	Sacks of Machine-dressed Seed.	Sacks of Undressed Seed.
Auckland	397	96
Poverty Bay	16	29
Hawke's Bay	269	352
Taranaki	446	5
Wanganui	161	3
Palmerston North	245	7
Wairarapa	45	..
Wellington	250	43
Marlborough	79	15
North Canterbury	48	..
Mid-Canterbury	23	..
South Canterbury	41	..
Otago	23	..
Southland	4	..
Totals..	2,047	550

A large proportion of the 250 sacks sent to Wellington has been redistributed to the South Island, but these returns are not yet available. One would be safe in assuming that 2,500 to 3,000 bushels have reached the South Island—enough to sow down between 1,600 to 2,000 acres. In addition to this a proportion of the seed distributed in the North Island is being sown for further seed-production.

Nothing very definite will be known about new areas entering for certification till December, but indications are very promising.

Brown-top Seed.

During the past few years the export of brown-top seed has increased very considerably, and the trade has become sufficiently important to warrant steps being taken to make available seed certified free from red-top. There has been no scarcity of areas and therefore of seed to fill export requirements, and thus there is every reason for harvesting only those free from red-top. Many of the overseas buyers were demanding a guarantee to this effect, and therefore the project met with the ready co-operation of merchants.

Unfortunately, the United States created a tariff duty of 40 cents per pound on all imported brown-top seed. News of this arrived at a time which just enabled merchants to ship a portion of the harvest to land before the tariff became operative. Dressing-stations worked day and night to get away as much seed as possible, and the Department's officers in Otago and Southland found it impossible to cope with the demands for their services. Merchants preferred to ship without the necessary tagging and sealing rather than have seed left on their hands.

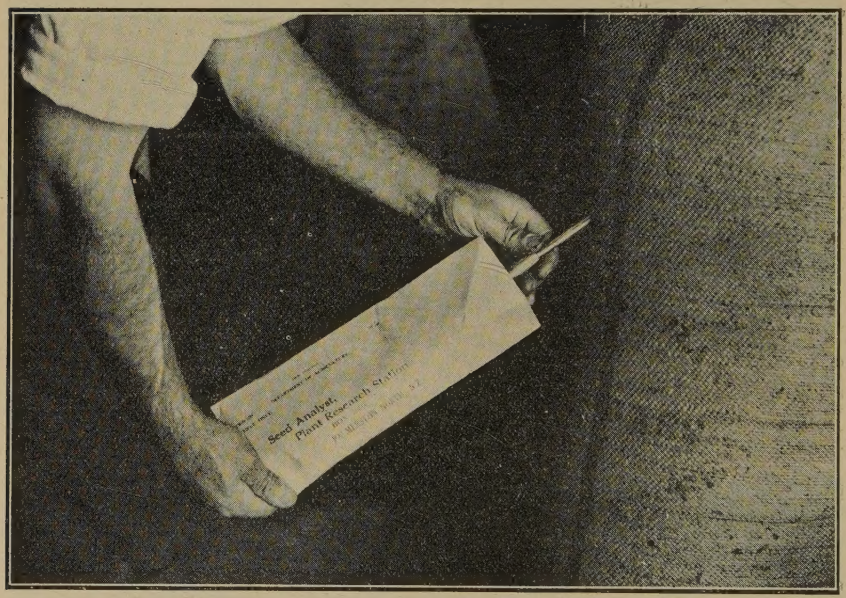

FIG. 5. SAMPLING SEED FOR PURITY AND GERMINATION ANALYSIS.

The final operation consists in drawing a representative sample from each sack in the line. This sample is forwarded to the Plant Research Station for purity and germination analysis, and a certificate is issued to the holder of the seed.

[*Photo by H. Drake.*

Nevertheless the officers concerned coped very effectively with these difficulties and inspected 178 areas, of which 154 were passed. This represents an area of approximately 22,000 acres declared free from red-top, and the bulk of the produce from this area was branded in the field and eventually machine-dressed, and tagged and sealed for export. Actually 168,958 lb., or over 75 tons, of machine-dressed seed was sealed. Several lots of certified seed harvested in South Canterbury were sent to Dunedin for machine-dressing. This brings the total to 170,071 lb., or approximately 76 tons.

Any estimate of the yield per acre computed from these figures is very misleading, and works out at under 10 lb. per acre. The position is that although an area of 15,486 acres in Southland and Otago declared free from red-top produced 153,379 lb. of seed, only the heavier-seeded and more accessible areas would be stripped. There

is a considerable loss in the machine-dressing of brown-top seed. Thus 48,132 lb. from Otago lost 16,832 lb., equivalent to 35 per cent.; and 78,418 lb. from Southland lost 29,789 lb., or 37 per cent.

White Clover.

The certification of old-pasture white clover was commenced in a more or less experimental way during the season 1928–29. Operations were somewhat more extensive during 1929–30, 734 acres having been passed and harvested. The seed from 664 acres was machine-dressed, with the following results: Into machine, 89,691 lb.; out of machine, 60,747 lb.; loss, 28,944 lb.; percentage of loss, 32·38 lb.; yield per acre of machine-dressed seed, 91·5 lb.; yield per acre of undressed seed, 135 lb.

There was also 11,561 lb. of seed carried over from 1928–29 which was machine-dressed last season, yielding 10,595 lb. of dressed seed. In addition some seed was also machine-dressed out of old-pasture rye-grass, yielding 8,268 lb. The total amount handled in the 1929–30 season was therefore 79,610 lb., or approximately 35½ tons.

The basis for certification has been one of age, the standard being that the pasture must be five years old or over. Seed harvested from these pastures may be said to be superior to the average, eliminating as it does most of the short-lived Dutch types. Nevertheless the term "old pasture" does not imply any particular strain, and will be replaced as soon as possible by a standard based on strain.

According to trials undertaken by the Agrostologist to this Station, a very excellent strain of white clover exists in New Zealand in sufficient quantities to warrant certification. The presence of this strain is probably responsible for the popularity of our clover in Britain, and if it were possible to isolate this a very satisfactory export trade might eventuate. Steps are therefore being taken to locate as many areas as possible producing this type, and the certification of this as "N.Z. Wild White" will probably replace the certification of "Old Pasture White" in the 1931–32 season.

The certification outlined has been carried out by officers of the Fields Division, Department of Agriculture, who deserve great credit for the volume and accuracy of the work they have achieved. The writer is indebted to Mr. J. H. Claridge, Assistant in Agronomy, for help in taking out and tabulating the figures quoted in this review.

Casein for Export.—The quantity of casein graded by the Dairy Division during the year ended 31st March last totalled 2,040 tons, being 150 tons in excess of the total for the previous year. The major portion of the casein graded—90 per cent.—consisted of the lactic variety, the balance of 10 per cent. being rennet casein. Quality was of a uniformly high standard, and the product is considered equal to the best offering on overseas markets. A charge of 1½d. per hundredweight for grading casein was in operation during the whole year, and although this service is optional to the exporter the greater part of the output was graded prior to shipment.

IODINE CONTENT OF LAMB THYROIDS.

NEW ZEALAND ANALYSES COVERING TWELVE-MONTH PERIOD.

B. W. Simpson, Rowett Research Institute, Scotland. (On loan to Chemistry Section, New Zealand Department of Agriculture.)

According to Orr and Leitch ("Iodine in Nutrition," 1929), the most important factor affecting the iodine content of the thyroid gland is the iodine content of the food or the intake of the animal. This overshadows differences due to species, age, or sex.

Kendall (*Journal of Biological Chemistry*, LXXX, No. 2, Dec., 1928) found a 300-per-cent. variation in the iodine content of thyroid glands throughout the year. Seidell and Fenger, working on American sheep, also found a seasonal variation (*Journal of Biological Chemistry*, XIII). Martin, working on English sheep, found only a variation of 0·10 to 0·13 per cent. fresh weight (*British and Colonial Druggist*, LXII). McCarrison has also shown that there is a seasonal prevalence of goitre in humans.

Lowe (*Quarterly Journal of Microscopical Science*, Feb., 1930) states that in all young animals the thyroid gland goes through alternate periods of activity and rest, and these changes are correlated with the season. A colloid condition of the gland prevails during the autumn and early winter months, this being replaced by a more active condition which continues till the beginning of the summer, when it gives way once more to the colloid condition. In older animals Lowe states that there are no such obvious seasonal changes, the colloid state being most commonly present. In aged animals Lowe found the colloid condition to be the rule, and the glands did not appear to respond to sexual or seasonal influences.

According to Lowe, the average weight of the gland in young male sheep is 2·34 grammes and in females 1·98 grammes in autumn and winter, and in spring the average is 2·96 grammes. In summer female lambs had thyroids weighing 2·43 grammes, males 2·37 grammes, yearling males 3·8 grammes, and yearling females 2·6 grammes. Another factor which influences the glands of females at least, besides iodine intake and seasonal variation, is temperature. Generally speaking, the return to the colloid condition coincides with increase of temperature. (Mills, *American Journal of Physiology*, 46).

Analyses of New Zealand Specimens in 1929–30.

The following tables give the iodine content of lambs' thyroids taken in this country between July, 1929, and June, 1930. These specimens were sent to the Department's chemical laboratory for analysis throughout the year and have been tabulated according to the date taken, so that thyroids from one area may be compared with those from another at the same time of the year. The maximum amount of iodine is said to be in the gland in the autumn and early winter. The minimum is said to be in the spring.

January, 1930.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Karamu, South Auckland ..	10/1/30	2·3	0·002	0·105
Wairarapa; weak lamb	9/1/30	1·3	0·002	0·127
Carterton	7/1/30	3·0	0·002	0·065
Marton	29/1/30	2·5	0·010	0·164
Waimea Plains, Nelson (10 miles from sea); ewe lamb	23/1/30	2·1	0·001	0·049
Gore (20 miles from sea) ..	23/1/30	2·32	0·0008	0·035
Otautau; four-months lamb ..	20/1/30	5·8	0·002	0·036
Ryal Bush, Southland; four-months lamb	22/1/30	3·2	0·002	0·060
Ditto	22/1/30	4·5	0·002	0·036
Pomahaka, Otago; four-months lamb	27/1/30	3·5	0·003	0·071
Tokonui, Southland; four-months lamb	27/1/30	3·5	0·001	0·035

The lamb from Wairarapa had a thyroid under the normal weight. Small glands seem to be the rule on lime-deficient areas. The Otautau, Ryal Bush, Pomahaka, and Tokonui lambs all have thyroids over the normal weight for their age and for this season. Lambs from those areas and from the Waimea Plains and from Gore would probably improve in condition and growth if fed additional iodine in the form of a drench or lick. Four grains of potassium iodide a week is the optimum dose.

February.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Kaikohe, North Auckland; seven-months lamb	28/2/30	2·9	0·0035	0·121
Herekino, North Auckland; six-months lamb	7/2/30	2·8	0·0021	0·075
Ashburton: five-months lamb ..	12/2/30	4·2	0·001	0·028
Valetta, South Canterbury ..	1/2/30	3·3	0·001	0·037
Lincoln; one year	3/2/30	4·9	0·004	0·080
Murchison; wether lamb ..	6/2/30	2·75	0·0017	0·063
Bishopdale, Nelson; ewe lamb ..	6/2/30	3·30	0·0038	0·115
Stoke; ewe lamb	6/2/30	3·20	0·0012	0·039
Murchison (Hunter's Station) ..	6/2/30	2·21	0·0007	0·033
Richmond, Nelson	12/2/30	4·15	0·0007	0·017
Motueka, Nelson; river-flat ..	12/2/30	2·70	0·0015	0·055
Owen..	12/2/30	3·15	0·0005	0·017
Owen Junction	12/2/30	3·25	0·0009	0·029
Invercargill	18/2/30	1·9	0·001	0·073
Ahaura, Westland	13/2/30	44·9	0·0026	0·006
,, ,, ...	13/2/30	24·7	0·0043	0·018
,, ,, ...	13/2/30	20·8	0·0056	0·027

Compared with the Kaikohe and Bishopdale lambs' thyroids all the others are low in iodine. The thyroids from Ashburton, Richmond, Owen, and Ahaura all have below the critical percentage—

0·03 of iodine. Below this percentage the thyroid gland functions imperfectly. The Ahaura glands are extremely deficient in iodine.

March.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Pakaraka, North Auckland; seven-months lamb	10/3/30	2·9	0·0026	0·088
Pohangina, Wellington; eight to nine months	7/3/30	3·5	0·0008	0·024
Weedon's, Canterbury; six months	6/3/30	2·7	0·0009	0·035
Ross, Westland; six months ..	12/3/30	24·3	0·004	0·017
,, ,, ,, ..	12/3/30	13·0	0·001	0·011
,, ,, ,, ..	12/3/30	4·8	0·001	0·030
,, ,, ,, ..	12/3/30	6·0	0·002	0·025

The lambs' thyroids from Ross and Palmerston North are all deficient in iodine. The Canterbury lambs' thyroids are very low, and this at the time of the year when glands have the maximum amount of iodine.

April.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Lincoln; one-year lamb ..	8/4/30	4·2	0·003	0·069
Methven, Canterbury; seven months	29/4/30	10·8	0·0068	0·063
,, ,, ,,	29/4/30	6·4	0·0027	0·042
,, ,, ,,	29/4/30	3·3	0·0014	0·043
Ahaura, Westland; seven months	7/4/30	..	..	0·023

Methven lambs' thyroids are all over the normal as regards size, and, although not deficient in iodine, the content is low. The Ahaura lambs' thyroids are still deficient.

May.—No samples were sent for analysis during this month.

June.

Place and Description.	Date taken.	Weight of Gland.	Iodine. Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Dunedin	2/6/30	166·85	0·013	0·008
Blenheim; "bowie" lamb, seven months old	7/6/30	0·55	0·0002	0·029
Blenheim; "bowie" lamb, ten months old	25/6/30	1·70	0·0007	0·057

The thyroids of the lambs suffering from "bent leg" ("bowie" lambs) are very small in size, and the iodine content is low. There

is obviously another mineral deficiency—probably lime—in this area. The first thyroid in the June list came from the Dunedin abattoir and is goitrous.

July, 1929.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Tai Tapu, Canterbury	1/7/29	3·0	0·0001	0·032

Nine glands were obtained from Tai Tapu in July. The average weight and iodine percentage of these are given. This is a reputed goitrous area. The iodine content of pasture and milk samples from this area is low. These glands received were normal, but verging on the critical iodine percentage (0·03 per cent.).

August.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Wairarapa; one to two months ..	7/8/29	3·6	0·005	0·0151
Wairarapa (Carterton); one to two months	14/8/29	3·0	0·0003	0·110

These glands are quite normal.

September.—No glands were received in this month.

October.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Wanaka, Otago; newly born lambs	10/10/29	0·27	0·0002	0·0009
,, ,, ,,	10/10/29	3·2	0·0009	0·030
,, ,, ,,	10/10/29	10·8	0·0001	0·001
,, ,, ,,	10/10/29	60·9	0·0003	0·0005
Maniototo, Otago; newly born lambs	19/10/29	1·6	0·002	0·112
,, ,, ,,	23/10/29	1·3	0·002	0·153
,, ,, ,,	26/10/29	0·49	0·0003	0·050
,, ,, ,,	29/10/29	1·08	0·001	0·091
Otago; deformed fœtus ..	31/10/29	1·3	0·0003	0·019
Otago; newly born	31/10/29	0·86	0·0009	0·104
,, ,, ...	31/10/29	0·77	0·001	0·142
,, ,, ...	31/10/29	1·12	0·002	0·187
Otago; deformed fœtus ..	31/10/29	0·48	0·0004	0·076

The Wanaka lambs' thyroids are deficient in iodine, with one exception. Some of the Otago lambs' thyroids are extremely small in size and have a low iodine content. They resemble the Blenheim glands in this respect.

November.

Place and Description.	Date taken.	Weight of Gland.	Iodine Content.	Percentage of Iodine.
		Grammes.	Grammes.	
Wallaceville, Wellington	15/11/29	0·94	0·0006	0·061
Mangamahu, Wellington ..	29/11/29	0·80	0·0001	0·012
Taihape, Wellington; three months old	13/11/29	2·04	0·001	0·048
Levin; three months old ..	13/11/29	2·6	0·003	0·112
Maniototo, Otago	4/11/29	1·5	0·0003	0·210
,, ,, ...	4/11/29	1·7	0·002	0·125
,, ,, ...	4/11/29	1·7	0·002	0·140
,, ,, ...	4/11/29	1·97	0·001	0·123
,, ,, ...	5/11/29	1·2	0·0008	0·066
,, ,, ...	5/11/29	1·04	0·0018	0·169
,, ,, ...	5/11/29	1·02	0·0012	0·123
Otago; deformed fœtus ..	9/11/29	1·5	0·003	0·167
Maniototo, Otago	9/11/29	0·99	..	..
,, ,, ...	9/11/29	0·93	0·001	0·119
,, ,, ...	9/11/29	1·61	0·001	0·090

The Mangamahu gland is extremely deficient, yet the gland is very small. The Taihape and Levin glands are interesting because they are exactly comparable as regards age and season.

December.—In this month twenty-seven glands were obtained from Wairarapa lambs. The average weight was 2·3 grammes, and the iodine percentage 0·03—on the verge of deficiency.

Conclusion.

The iodine content of the thyroids of lambs born and bred on definite areas seems to give a fair indication of the amount of iodine available on those areas. Systematic advisory work on iodine feeding to stock could be based on such analytical data. More data and more widespread investigations are, however, required.

TURNIP-MANURING IN CANTERBURY.

RECOMMENDATIONS TO GROWERS.

Fields Division, Department of Agriculture.

During the past six years turnip-manuring experiments to test the effect of various manures on field germination and yield have been conducted in Canterbury. The results of all experiments will be published in a subsequent issue of the *Journal*. The present brief article is intended only to indicate the salient features of the trials and provide recommendations to growers for the coming sowing season. For a fuller explanation of the work already conducted and in progress readers are referred to the *Journal* for October, 1928, page 245.

Superphosphate.

Every farmer knows that in almost all cases some form of phosphate is essential for the successful growing of roots in New Zealand. Under

the comparatively low rainfall conditions experienced in Canterbury there can be no doubt that superphosphate is the most efficient form of phosphate. Unfortunately, super sown in contact with the seed has an injurious effect on germination. The effect increases as the amount of super sown increases. It also varies with the amount of moisture in the soil at time of sowing. The following figures indicate the extent of the injury:—

1 cwt. of superphosphate (seed and manure in 14 in. rows): The average of twenty-five trials in which the germination on plots receiving 1 cwt. of super is compared with the germination on plots receiving no manure, ground rock phosphate, or super plus carbonate of lime (equal parts) shows that the super reduced the germination to 67 per cent. of that occurring on the other treatments mentioned. (Note: Experience indicates that rock phosphate or super plus carbonate of lime (equal parts) do not injure germination.)

2 cwt. of superphosphate (seed and manure in 14 in. rows): In twelve of these trials it was found that 2 cwt. of super caused more serious injury still, lowering the germination to about 47 per cent. of that from treatments which had no adverse effect. In one case a super 2 cwt. area germinated only 8 per cent. of that from the best treatment—super plus lime.

Superphosphate plus Carbonate of Lime.

The injury due to superphosphate can be entirely overcome by mixing the super with an equal weight of carbonate of lime (ground limestone) about one week before sowing. The average yields from ten trials in which super and super plus lime were used are as follows, all seed and manure being in 14 in. rows); Super 1 cwt., 11·2 tons per acre; super 2 cwt., 10·7 tons; super 1 cwt. plus carbonate of lime 1 cwt., 14·5 tons; super 2 cwt. plus carbonate of lime 2 cwt., 16·7 tons.

Recommendations to Growers.

(1) Mix superphosphate and carbonate of lime (equal parts) at least one week before sowing. The mixture should be left in a heap, as it tends to set if put in bags which are stacked. If left in a heap it can be easily broken up before use.

(2) Use 2 cwt. per acre of the mixture on light land, and 4 cwt. on heavier land of higher rainfall. It must be remembered that the lime will not replace the phosphate.

(3) Generally speaking, it will be advisable to sow 1 oz. to 3 oz. less seed than normally used, or the crop may be too thick.

Farmers are strongly recommended to try the super plus lime mixture. Provided weather conditions permit of germination at all, good results will be obtained. The mixing of super and carbonate of lime does not reduce the efficiency of the super to any appreciable extent.

—A. W. Hudson, Crop Experimentalist, Plant Research Station.

Lice in Sheep.—The Live-stock Division reports that during the past year a considerable reduction has taken place in the number of lice-affected sheep found in saleyards.

OFFICIAL HERD-TESTING OF PUREBRED COWS.

SUMMARY OF THE THIRD SEASON'S WORK, 1929–30.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

DURING the peak month of its third year of operation—covering the period 1st October, 1929, to 30th September, 1930—the Official Herd-testing system was carried out for some 1,338 cows in the hands of 130 of our C.O.R. breeders.

The general position regarding the number of cows tested and their average production, breed by breed, is indicated by Table 1. This table omits some forty-three cows other than registered purebreds, which were tested by special arrangement. The classification adopted is on the basis of all cows on test six months (180 days) or more, which so far has proved the most useful and representative. The O.H.T. is a ten months' test, 305 days being the maximum testing-period permitted by the rules under which this work is conducted. In connection with the season's testing it may be mentioned that the total number of cows entered on our lists was really 1,466. Although the total number appears in the table as 1,304, there were 115 registered purebred cows and four cows other than registered purebreds which did not complete 180 days on test.

Table 1.—Official Herd-testing in Two Part Seasons on Basis of all Cows on Test for 180 Days or more.

Breed.	Number of Breeders.	Number of Cows.	Average Yield for Season.		
			Days in Milk.	Milk.	Butterfat.
Season 1928–29.					
				lb.	lb.
Jersey	99	817	276	5,705·1	306·30
Friesian	24	546	274	7,976·8	275·17
Ayrshire	8	106	282	7,182·8	280·89
Milking Shorthorn ..	7	108	266	6,496·6	250·39
Red Poll	4	59	261	5,901·1	239·77
Totals ..	142	1,636	275	6,618·3	288·17
Season 1929–30.					
Jersey	95	643	278	5,883·6	316·48
Friesian	17*	399	280	8,063·1	277·81
Ayrshire	8	97	281	7,204·9	285·75
Milking Shorthorn ..	7	131	273	6,561·5	254·07
Red Poll	3	34	282	5,975·4	242·04
Totals ..	130	1,304	279	6,717·5	294·21

* One Friesian breeder also testing Jerseys.

Figures taken out on the 100-days-or-more basis (the principal classification for ordinary Group and Association herd-testing) give an average O.H.T. production result of 287·56 lb. of butterfat in 273 days, as compared with 253·61 lb. in 247 days for all cows on ordinary

Table 2.—Average Production in Classes and Breeds for all O.H.T. Cows.

Class.	Season 1928–29.				Season 1929–30.			
	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.	Number of Cows.	Average Days.	Average Milk.	Average Butterfat.
			Jersey.					
			lb.	lb.			lb.	lb.
Two-year-old and under	283	274	4,849·7	261·68	246	282	5,105·9	276·92
Three-year-old	172	276	5,691·2	311·31	92	275	5,994·2	325·24
Four-year-old	115	276	6,151·0	333·48	89	270	6,209·7	337·00
Mature	247	278	6,487·3	341·27	216	280	6,587·9	349·34
			Friesian.					
Two-year-old and under	183	279	6,751·8	234·88	112	282	6,500·9	228·08
Three-year-old	106	275	8,055·2	278·84	70	280	8,196·6	279·53
Four-year-old	75	273	8,906·2	303·35	70	278	8,737·4	296·86
Mature	182	269	8,779·8	301·94	147	279	8,868·7	306·36
			Ayrshire.					
Two-year-old and under	19	287	6,187·7	253·79	18	286	6,508·2	263·69
Three-year-old	20	282	6,765·4	259·98	20	281	7,027·8	279·67
Four-year-old	21	276	6,987·9	275·93	15	265	6,367·1	256·32
Mature	46	283	7,864·3	303·43	44	284	7,856·1	307·56
			Milking Shorthorn.					
Two-year-old and under	22	268	4,610·6	187·84	33	282	5,165·9	205·79
Three-year-old	19	272	6,143·1	227·97	19	263	6,309·8	247·98
Four-year-old	13	262	6,714·4	263·21	25	278	7,224·7	285·69
Mature	54	263	7,336·9	280·67	54	268	7,195·9	271·08
			Red Poll.					
Two-year-old and under	18	263	4,842·7	194·20	10	289	5,483·0	231·35
Three-year-old	8	267	5,706·9	226·29	11	293	5,861·5	235·63
Four-year-old	12	260	6,203·7	259·30	2	272	4,610·7	202·23
Mature	21	257	6,709·8	272·81	11	267	6,785·1	265·41

herd-test during the 1929–30 season. The average production for all cows certificated under the C.O.R. system in 1929 was 469·95 lb. butterfat.

Table 2 provides a production classification according to age and breed.

Although last year Official Herd-testing showed a slight falling-off in number of cows tested as compared with 1928–29, present prospects indicate a considerable increase for the current year, 1930–31.

ESTABLISHMENT OF LUCERNE ROOT-NODULES.

FURTHER EXPERIMENTS WITH THE INOCULUM.

W. D. Reid, Mycological Laboratory, Plant Research Station, Palmerston North.

In an article which appeared in this *Journal* for February, 1929, on the result of mixing various fertilizers with inoculated lucerne-seed it was shown that superphosphate kills the nodule organism and that rock phosphates and basic slag do not. Since then field experiments have proved this first conclusion, and in the present account these trials and related experiments are discussed.

In the field trials sown in January last a closer approximation to normal farming procedure was obtained than in the previous laboratory experiments, the only variation from farmers' methods being that the sowing was done in 14-in. drills to facilitate later observations. Commercial lines of manures and seed were used, and the cultures for inoculating the seed were drawn from stocks prepared at the Mycological Laboratory and intended for distribution to farmers. In the inoculation of the seed the method followed our usual recommendations, which at that time suggested the use of one 6-oz. bottle of culture for 80 lb. of seed. Owing to the small quantity of seed required for the whole experiment, drying was rapid, taking not more than ten minutes from the time of application of the milk-culture. Apart from the application of inoculum the seed was not treated in any way prior to mixing with the manure. The seed and manure mixtures were drilled, in 14-in. drills, the seed at the rate of 14 lb. per acre, and the manure at 3 cwt. per acre, except sulphate of ammonia, which was sown at 1 cwt. per acre. Sowing was done half an hour after mixing the inoculated seed and manure, a delay which is more or less comparable with that which would occur on a farm.

After allowing three months for the development of the plants and nodules, portions of the plots were dug and the roots washed and examined. Table 1 indicates the lay-out of the plots (which were in duplicate) and the results obtained by the various treatments.

A general view of the areas showed outstanding growth differences, and the examination, as indicated, demonstrated extreme variations in the production of nodules. The examination showed that in those areas sown with super and sulphate of ammonia the nodule formation was negligible, or where, as in super D, a few were present they were limited to one or two on each of the positive plants. Further, in super D the plants with nodules were present in groups in which the

Table 1.

Plot.	Treatment.	Average Percentage of Plants with Nodules.	Average Number of Plants in 3 ft. of Drill.
1	Seed not inoculated, plus superphosphate C ..	0	78
2	Seed inoculated, plus sulphate of ammonia ..	3	31
3	,, plus super C*	0	86
4	,, plus super D*	18	85
5	,, plus basic super	78	95
6	,, plus super plus lime†	96	111
7	,, plus Nauru rock phosphate ..	98	121
8	,, plus Ephos phosphate	97	126
9	,, plus basic slag	99	119
10	Seed not inoculated, plus super D plus inoculated soil	26	68

* Super C and Super D are two different manufactures of commercial superphosphate.

† Super plus lime is a mixture of equal parts superphosphate and ground limestone.

nodules were confined to restricted centres of infection in the intertwined roots. Fig. 1 explains in part this grouping of the nodules. It appears that a limited spreading of the organism has taken place around some seed or seeds unaffected by the manure. The plant-growth of these super and sulphate of ammonia plots was poor both

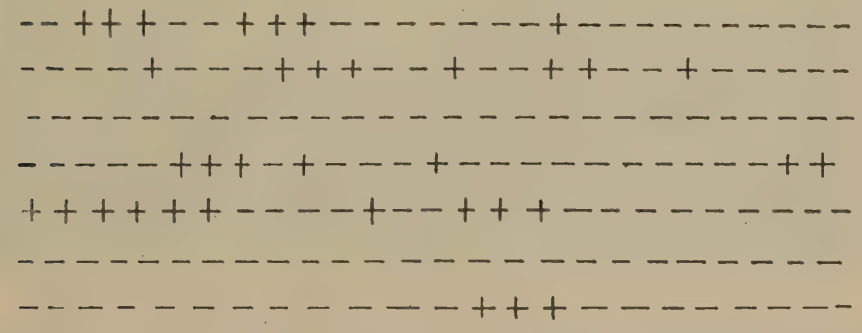

FIG. 1. RELATIVE POSITIONS OF THE PLANTS IN PORTION OF A SUPERPHOSPHATE "D" DRILL, SHOWING GROUPING OF THOSE WITH NODULES.

The rows in the diagram represent a continuous drill from left to right; hence the crosses (+ +) at the end of the third row and the beginning of the fourth are in the same group.

in vigour and colour, and a marked contrast to the healthy appearance of the other areas. Fig. 2 gives a good idea of this difference.

The basic-super treatments provided a satisfactory development of nodules and plants, although at the time of the examination the nodules were small and confined to the manure seed zone. The crop-growth was excellent, but no better than that of the super-plus-lime areas. This inoculation result does not agree with that obtained in the previous laboratory trials, in which a number of different lines of this manure killed most of the bacteria. Nevertheless, killing of the

bacteria to the extent of 20 per cent. did occur, and therefore, since more suitable fertilizers are available, the mixing of basic super and inoculated seed is not recommended.

Examination of the super-plus-lime, Nauru, Ephos, and basic-slag sowings showed plant inoculations of approximately 100 per cent., with an average nodule-production of ten nodules per plant. Further, in the super-plus-lime and basic-slag drills the nodules were not only present in the manure zone, but had also spread some inches below this level, suggesting that the conditions of sowing favoured a rapid

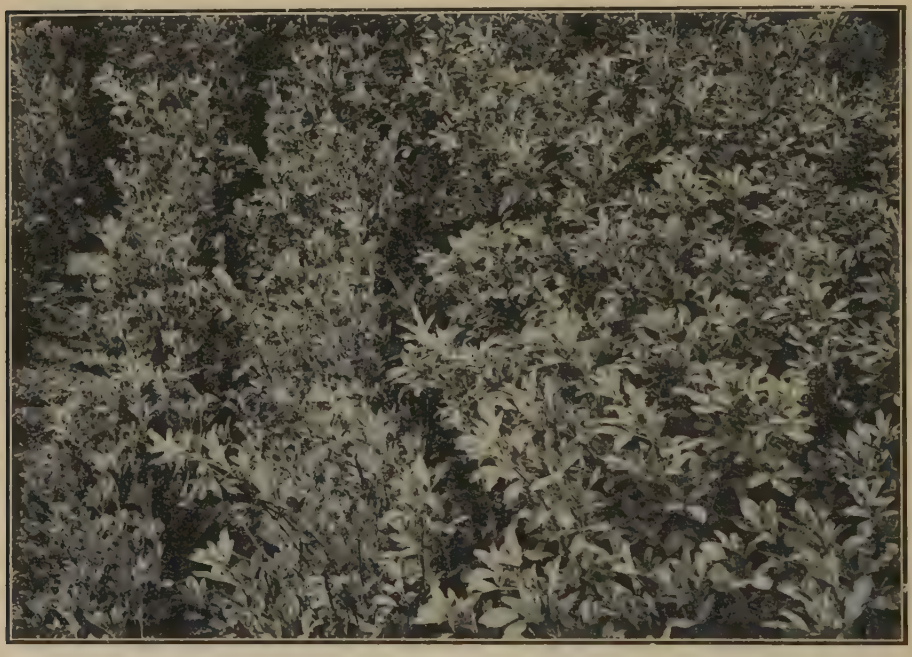

FIG. 2. VIEW AT JUNCTION OF TWO PLOTS, SHOWING CONTRAST IN GROWTH.

On left, superphosphate plot (inoculation nil); on right, basic super plot (inoculation 78 per cent.).

development and migration of the bacteria. In crop-growth the super-plus-lime plots, together with the basic-super plots, were the most vigorous of the experiment. The Nauru, Ephos, and slag plots showed good colour and growth, but not so luxuriant as that in the previous two treatments (Nos. 5 and 6).

The inoculated-soil plot (No. 10) was necessarily sown in a different manner to the others. In this case the inoculated soil, obtained from an established lucerne stand, was drilled in 14-in. drills, and in these drills was then sown the mixture of super and commercial seed. The result in nodule formation was unsatisfactory, though better than that in the super plus inoculated-seed plots.

For the first few weeks after sowing the above-noted differences of growth were not evident. The super, basic-super, and super-plus-lime

plots gave the best early growth, but in the case of super this advantage was not maintained, presumably because of the absence of nodules. The poor condition of the super and the sulphate of ammonia areas persisted for ten months, and thereafter a gradual recovery took place. A further examination showed the presence of nodules, but it appears that through intercultivation and harvesting operations the nodule organism was distributed from the adjoining plots, or, as in the case of super D, from the original nodule groups.

Effects of Drilling and Broadcasting Superphosphate prior to Sowing of Lucerne.

Since superphosphate is considered one of the most suitable fertilizers for the early establishment of farm crops, another experiment was laid down to determine if full nodule-development could be obtained when using this fertilizer and inoculated seed. The experiment comprised areas of (1) super drilled in at different times before cross-drilling the seed; (2) super broadcast at intervals before seeding; (3) seed and super sown through the same coulter, but from different boxes; and (4) the other phosphatic manures and seed sown through the same coulter, but from different boxes.

The subsequent examination showed a satisfactory result in the superphosphate areas, for fully 90 per cent. of the plants were inoculated. On the other hand, the plant growth in the super predrilled and broadcast plots was not equal to that obtained by the methods (3) and (4). The drilling of the super and inoculated seed from the same coulter certainly gave a good early growth, but some killing of the organism still occurred, for the nodules were present in groups and not evenly distributed along the drills. Basic super, and super plus lime both gave excellent plant and nodule growth; and the Nauru, Ephos, and slag treatments, though 100 per cent. inoculated, still showed the somewhat retarded plant-growth. This experiment has shown that super can be used when sowing inoculated seed, provided (*a*) the manure is applied prior to seeding, or (*b*) the seed and manure are drilled from different boxes of the drill. Basic super and super plus lime are more satisfactory if both factors of early plant-growth and nodule-production are considered.

Longevity of the Organism on the Seed.

From time to time the question has arisen, How long will the inoculum remain viable after application to the seed? This problem has been subjected to a simple experiment in which the same line of inoculated seed has been sown at intervals from the time of treatment. The results were as follows:—

Time of Sowing Seed after Inoculation.	Percentage of Nodules.
2 days	100
4 days	100
1 week	100
2 weeks	95
3 weeks	95
4 weeks	4
6 weeks	Nil.

This experiment needs confirmation, but with our present knowledge it is evidently advisable to sow as soon as possible after treating.

Viability of Stock Cultures after Storage, and Rate of Application of Inoculum.

Another problem — of primary interest to this Laboratory — has arisen owing to the large demand for inoculum. During the season of 1929–30 cultures for over 18,000 lb. of seed have been supplied to farmers, and in order to economize laboratory work it has been found necessary to determine the viability of the organism in stock cultures and the amount of culture necessary to inoculate a given quantity of seed. For this field experiment the cultures were one, two, four, and six weeks' old at the time of application to the seed, and each one was applied at the rate of one 6-oz. bottle to 30, 60, 120, and 240 lb. of seed. The inoculated seed was sown with super plus lime from the same coulter, but from separate boxes of the drill. The results from all these variations of application were alike in that 100-per-cent. inoculations were obtained. The experiment has also shown that the present allowance of one 6-oz. bottle for 120 lb. of seed is more than sufficient, and that cultures prepared six weeks prior to application are as efficient as younger cultures.

Conclusions.

(1) The mixing of super or sulphate of ammonia with inoculated seed kills the nodule organism.

(2) The mixing of super plus lime, rock phosphates, or basic slag with inoculated seed gives excellent nodule-formation. Super plus lime gives the best plant-growth.

(3) Super can be used, provided (*a*) the fertilizer is broadcast or drilled before seeding, or (*b*) the manure and seed are drilled through the same coulter but from different boxes of the drill.

(4) Basic super or super plus lime when drilled as in (*b*) above gave the best plant and nodule growth.

(5) The drilling of super and seed over soil from an old lucerne stand has not proved satisfactory.

(6) The inoculum remains viable on the seed for three weeks in sufficient amounts to give good inoculation, but very poor inoculation was obtained after four weeks' storage.

(7) One 6-oz. bottle of Laboratory culture is sufficient to inoculate thoroughly 240 lb. of seed.

(8) Laboratory cultures may be kept for at least six weeks without loss of inoculating efficiency.

AREAS IN COMMERCIAL ORCHARDS.

The total area of commercial orchards in the Dominion, as taken from the orchard registration cards for the year 1930–31 is 26,163 acres, comprising the following kinds of fruit: Apples, 17,855 acres; pears, 1,744; quinces, 198; peaches, 2,214; plums, 1,203; apricots, 885; nectarines, 359; cherries, 347; lemons, 956; oranges, 402 acres. Under the registration system "commercial orchard" is any orchard from which fruit is sold or intended to be sold, irrespective of the value of such sales.—*Horticulture Division.*

SOME COLOUR-PRODUCING ORGANISMS IN BUTTER-WASHING WATER.

G. F. V. MORGAN, Dairy Bacteriologist, Wallaceville Laboratory.

DURING a recent bacteriological survey of the numbers and types of organisms found present in the waters used for washing butter in the various districts of the North and South Islands four types were isolated that are capable of rapid production of pigment. These organisms have been reported on by bacteriologists working on dairy-produce in all parts of the world, and cause sudden though not frequent epidemics of discoloration the cause of which is very often difficult to trace and equally difficult to eradicate, though the trouble often vanishes as suddenly as it makes its appearance.

So far no trouble of this nature has been reported to the Dairy Division in connection with milk and cream, in which the fault most often occurs, but varied discoloration takes place in many defrosted butter-samples, including red and violet colours. So far these colours have been found to be due to moulds of the *Fusarium* type and certain *Monilia*, but the possibility exists that the colour-producing organisms present in washing-waters may also play a part in causing this type of discoloration.

With the object of investigating this matter pure cultures of four colour-producing organisms were isolated from samples of dairy-factory water-supplies, and were introduced into milk and cream and, finally, butter. The organisms isolated were (1) *Chromobacterium violaceum*, (2) *Rhodococcus rosaceus*, (3) *Bacterium fluorescens*, and (4) a short gram-positive rod forming a bright-orange pigment.

CHROMOBACTERIUM VIOLACEUM.

This organism is a fairly widespread and common contaminant of water-supplies, and has also been isolated from bacteriological exposures of factory atmospheres. Cultures of the organism when introduced into milk produced bright violet spots over the surface, with a violet margin round the container, in two days. At atmospheric temperatures, when the milk is held for longer than this, rapid digestion commences, leaving a discoloured layer of cream and a brown-coloured serum beneath. The same action may be noticed in cream, the colour being confined to bright violet spots on the surface, and no discoloration in the body of the cream. The colour produced seems to be due to a skin or pellicle of the organisms themselves rather than to a diffusion of colour through the milk or cream.

When cream that had been inoculated with a culture of *Chromobacterium violaceum* was allowed to develop the violet spot, and was churned into butter and allowed to incubate for ten days at atmospheric temperature, the butter acquired a slightly grey appearance on the surface only, with occasional small but definitely violet spots. No discoloration was noticed in the interior when the butter was cut into sections for examination. The flavour produced was slightly rancid and similar to a coconut flavour.

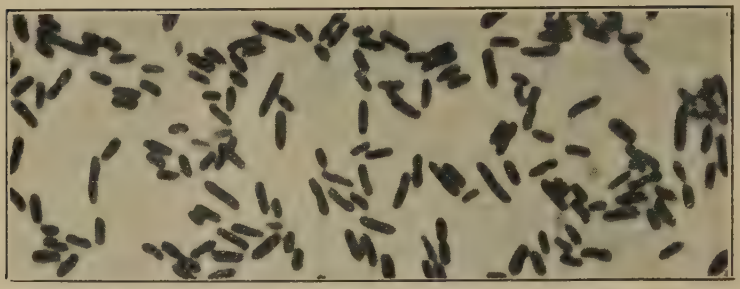

FIG. 1. CHROMOBACTERIUM VIOLACEUM ORGANISMS AS SEEN UNDER THE MICROSCOPE.

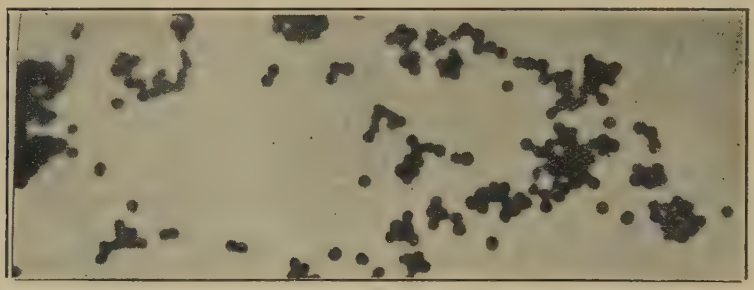

FIG. 2. RHODOCOCCUS ROSACEUS.

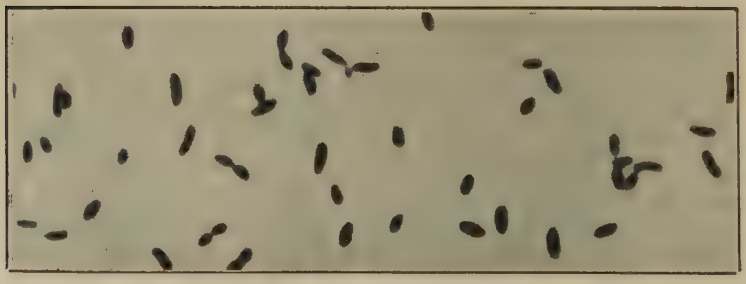

FIG. 3. BACTERIUM FLUORESCENS.

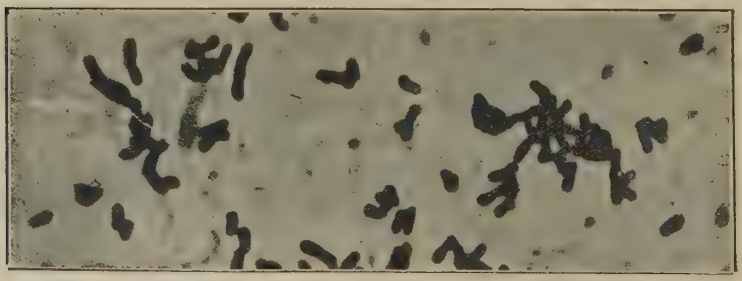

FIG. 4. THE ORGANISM WHICH PRODUCED A BRIGHT ORANGE COLOUR.

The cultural characteristics of *Chromobacterium violaceum* as observed were as follows: Milk and cream—violet patches on the surface only, followed by liquefaction; gelatine—liquefied; potato—weak growth; agar slant—deep violet glistening, forming a raised wrinkled violet skin in old cultures; gram negative rod; habitat—water.

RHODOCOCCUS ROSACEUS.

A culture of this organism was introduced into milk and held at 20° C. for two days. On examination a pink sediment was seen at the bottom of the flask, resembling the red deposit present in milk containing small quantities of blood—acidity produced—no coagulation, but slow digestion. In butter the colour is too light to be distinguishable. Confusion has sometimes arisen in bottled milks between milk containing this organism and milk containing small quantities of blood.

Cultural characteristics: Milk—acid digestion with red sediment; gelatine—slow liquefaction; agar—light pink, flesh-coloured growth luxuriant; gram positive coccus, growing best at low temperatures.

BACTERIUM FLUORESCENS.

Only recently have water cultures from certain butter-factories been found to contain this type of organism. It is, however, common and widely distributed in farm waters of a bad type, more particularly stagnant waters containing an excess of decaying vegetable matter. This organism produces a marked green pigment diffused through a clear medium on which it may be growing; the green colour, however, does not appear in dairy-produce, owing to the acidity developed by other organisms.

This type of organism is particularly dangerous as a contamination in butter-washing water, as it is among the few that have marked fat-splitting abilities and are therefore capable of rapidly producing rancidity, the rancidity and bad-flavour production starting from the outside of the butter and working inwards.

The pigment production that appears quickly in ordinary agar-shake cultures is of little importance in itself, except for the fact that it readily draws attention to the presence of this highly undesirable type of organism.

Cultural characteristics: Agar slant—viscous creamy growth; milk—alkalinity, coagulation and digestion (slow and viscous); gelatine—rapid liquefaction; gram negative rod.

CHROMOGENIC BACTERIUM ISOLATED AT WALLACEVILLE (CLASSIFICATION UNCERTAIN).

From cultures of certain factory water-supplies bright orange colonies have from time to time been isolated. These have been proved to consist of short, thick, gram-positive rods occurring in pairs producing a bright orange pigment in their colonies, but no diffusion of colour into the body of the medium in which they may be growing.

Cultures of this organism were introduced into milk and cream which was held at atmospheric temperature for three to four days. By

this time a thick orange surface-growth had appeared on the milk and cream, which gradually diffused into the body of the milk; a thick orange sediment was also apparent.

Butter was subsequently made from the inoculated cream, but showed no marked development of colour. The outside layers of the sample made from inoculated cream seemed in ten days slightly deeper in colour than that of the control. Cultures from this sample at this age showed that the organisms were still virile and present in considerable numbers.

Cultural characteristics: Milk—bright orange surface-growth and sediment; agar slant—bright orange, glistening, moist; gelatine—orange growth, slow liquefaction; potato—bright orange, dry; no acidity production; lactose not fermented; gram positive.

CLUB-ROOT IN TURNIPS

TEN YEARS' INVESTIGATION IN OTAGO AND SOUTHLAND.

R. B. TENNENT, Fields Superintendent, Department of Agriculture, Dunedin.

WITH the return of the season when turnip and swede growing is receiving consideration it will be opportune to review the work conducted by the writer in regard to the control of club-root (*Plasmodiophora brassicæ*) in this crop during the past ten years. In this article the general term "turnip" is used to include both ordinary and swede varieties.

In the early stages of investigation the writer was impressed by the reiterated assertions in agricultural text-books lauding the efficacy of lime in controlling club-root, and trials were laid down on the Gore Experimental Area for the purpose of determining if lime actually was effective in controlling club-root. At the outset some doubt was felt as to its efficacy, seeing that over 60,000 tons of lime was being used annually in Otago and Southland and yet club-root had been increasing year by year.

LIMING EXPERIMENT FOR CONTROL OF CLUB-ROOT.

In November, 1920, a piece of land on the Gore Experimental Area, known to be heavily infected with club-root, was selected for the purpose of testing the value of lime for control. This plot was divided into five equal blocks running north and south, and treated with the following applications of burnt lime per acre: Plot 1, 2 tons; Plot 2, 16 tons; Plot 3, control (no lime); Plot 4, 8 tons; Plot 5, 4 tons.

In 1921, a year after the application of lime, a crop of cabbages grown on a portion of this block reached maturity during the season, and the plants were then pulled and examined (by naked eye) for the presence or otherwise of club-root, with results as shown in Table 1. The result of this portion of the trial clearly indicated that the application of lime did not lessen the percentage of infection.

In 1922, two years after the application of lime, a crop of Hardy Green Globe and Webb's Renown turnips was sown down on the limed block, with a view to ascertaining whether after a period of years had

Table 1.

Plot.	Lime per Acre.	Total Number of Plants.	Percentage of Infection.
	Tons.		
1	2	91	26
2	16	97	13
3	Control (unlimed)	114	13
4	8	114	18
5	4	106	15

elapsed since the application of lime its effectiveness might be enhanced. These crops grew to maturity and the following results were obtained :—

Table 2.

Plot.	Quantity of Lime per Acre applied in 1920.	Yield per Acre, 1922–23.	Percentage of Club-root Infection.
		Hardy Green Globe.	
	Tons.	Tons Cwt.	
1	2	22 6	57·0
2	16	28 0	3·0
3	..	25 9	48·3
4	8	35 6	24·0
5	4	31 0	20·8
		Webb's Renown.	
1	2	20 2	9·5
2	16	25 0	9·6
3	..	16 0	21·6
4	8	26 16	12·0
5	4	24 13	16·8

The results of this trial offered interesting material for thought, and apparently point to lime, after being several years in the soil, having some inhibiting effect on the prevalence of the club-root organism. Where large quantities of lime had been applied, as in the case of the plot which received 16 tons per acre, there was certainly less disease apparent than in the plot which received no lime. One would like very much to use these results as an argument that lime when applied in fairly large quantities would lessen the disease, but the figures must not be accepted on their face value as giving a true indication of the intensity of attack. The plots were small and the roots grown thereon few in number. One or two bulbs attacked by the disease consequently make the percentage of infection read very high. In other words, this experiment will not bear critical examination on account of the fact that an insufficient number of replications of each treatment were carried out. Furthermore, there is every likelihood that the ground upon which the experiment was conducted was not uniformly infected to the same intensity, and this would certainly make for wrong interpretation of results. All that can be said in regard to the experiment is that a strong indication was given supporting the oft-repeated assertion that lime counteracts club-root; further, as a result of these

experiments it would appear that the effect of lime in this connection is not apparent until some years after the application has been made.

In 1924 an improved type of trial was conducted on the Gore area. More replications were made, and the trial was of a dual nature in that a comparison was attempted between a Danish swede named Bangholm—supposed to be fairly resistant to club-root—and a well-known commercial variety of swede. The results of this experiment, carried out four years after the original liming, are shown in Table 3. The table combines four plots in each of the two varieties, and averages the percentage of infection under each heading.

Table 3.

Variety.	4 Tons Burnt Lime per Acre.		Percentage of Infection.	8 Tons Burnt Lime per Acre.		Percentage of Infection.	Control (no Lime).		Percentage of Infection.	16 Tons Burnt Lime per Acre.		Percentage of Infection.	2 Tons Burnt Lime per Acre.		Percentage of Infection.	Average Percentage of Infection over 5 Plots.
	Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		Club-rooted.	Sound.		
Bangholm ..	26	69	27·3	44	84	34·3	41	91	31·0	35	98	26·3	46	57	44·6	32·7
Commercial ..	82	19	81·9	77	31	71·3	145	11	93·0	96	35	73·3	96	4	96·0	83·1

NOTE.—The figures under " Club-rooted " and " Sound " represent numbers of roots.

Again in this case there are indications that lime, even four years after application, has some tendency to control club-root, although it has to be admitted that the results are not very encouraging. It appears anomalous that the percentage of infection where 2 tons of lime was applied per acre should be higher than where no lime was used, but probably the difference is non-significant.

It will be observed that in this trial Bangholm swede showed a distinct superiority in club-root resistance to the commercial variety grown, and this test was really the forerunner of numerous others conducted in an endeavour to determine whether certain varieties or strains of turnips were actually club-root resistant.

The whole question of the effect of lime upon club-root is at present being again reviewed in comprehensive trials laid down this year at Gore Experimental Area, and at the Plant Research Station, Palmerston North.

TRIALS OF SO-CALLED CLUB-ROOT-RESISTANT STRAINS OF TURNIPS AND SWEDES.

It has always been recognized that individual roots within a crop of turnips show a marked resistance to club-root disease, and one of the most hopeful types of investigation has been to ascertain whether there does exist any particular variety or strain of turnip or swede which will grow well in club-root-infested ground. Numerous trials have been carried out at the Gore Experimental Area with the object of ascertaining if the claims made by certain breeders of turnip-seed in regard to club-root resistance were justified, and in the majority

of cases negative results were obtained. It is not intended in this article to traverse all the experiments laid down in this connection, but brief mention will be made of those which showed promise.

In 1923 the writer had the opportunity of testing a Danish swede named Bangholm Purple-top, for which was claimed ability to withstand heavy club-root infection. This swede was sown on severely club-rooted land on the Gore Area, and of 120 roots pulled and inspected nineteen were found to be infected. There is no question that this Bangholm swede was moderately resistant to club-root, but its chief disadvantage lay in the fact that the bulb itself was poor in shape with very fangy roots.

A further trial of this swede was conducted in 1924 on the block referred to in the liming section of this article, this ground having been limed four years previously. As already mentioned, the Bangholm swede in this case showed a marked superiority over the commercial variety, less than 33 per cent. of the former being infected with club-root as against 83 per cent. in the case of the latter. This was a decidedly hopeful experiment, and clearly demonstrated that there did exist certain types of turnips more resistant to club-root than others.

During the same season, 1924, a number of trials were conducted on various farmers' properties, both with ordinary turnips and swedes, and were fully reported on in this *Journal* for April, 1925.* Of all the trials conducted during that season the most promising results in swede varieties were obtained from the Bangholm, and in turnips from Irvine's Green-top Yellow. In 1928 the Department of Agriculture obtained from Denmark a sample of swede-seed named Bangholm Improved Purple-top Herning Strain. Reports had been noted in regard to the club-root resistant qualities of this strain of Bangholm swede, and it was immediately put under trial. This strain of specially selected seed is referred to hereafter as Herning swede.

Trials with Herning Swede.

There can be no question that of all the trials conducted in an effort to obtain a club-root resistant swede those with Herning have proved the most successful, and the growing of this variety on club-root-infected land merits close consideration.

In 1928–29 a trial of Herning swede was conducted at the Gore Experimental Area, two other well-known and popular varieties of swedes being used as a control. The seed of all varieties was ridged in plots 2 chains in length, each plot consisting of four drills, and being replicated twelve times. The seed was sown at a rate of 1 lb. per acre in land heavily infected with club-root.

Although no germination counts were taken a good even germination occurred with each variety, there being no visible differences to record. From the time of germination until the beginning of January growth throughout proved fairly even and regular. At the time of thinning, however, during the middle of January, it was noticeable that, with the exception of the Herning strain, each variety of swede was badly infected with club-root. At the beginning of February each of the

* This article also discussed the great economic importance of the turnip crop to Otago and Southland, and consequently the necessity for club-root control work.

popular varieties had almost died out with club-root, but the Herning continued to grow vigorously. Only a few isolated plants of the popular varieties remained, forming a striking contrast to the dense rows of well-grown Herning bulbs.

A final examination of the block was made on 22nd May, 1929. By this time Herning was the only variety left growing, and a close examination was carried out to ascertain the percentage of club-root and dry-rot infection present. Of 741 roots examined 145 proved to be infected with club-root and 313 with dry-rot. The yield from the crop of Herning was estimated at 26 tons 13 cwt. 3 qr. per acre, whereas no yield was obtained from the other varieties.

In view of the fact that this trial was conducted on land heavily infected with club-root, there is ample evidence that the Herning strain of Bangholm Improved Purple-top swede is highly resistant to the disease. It is not immune, however, from club-root or dry-rot.

In 1929 a further trial was laid down at Gore to obtain confirmatory evidence in regard to the resistance of Herning swede. The nature of the trial was similar to that sown down in 1928, three commercial varieties of repute being used as controls. In this trial each plot consisted of two ridged drills of the four varieties, ten replications of the commercial swedes being made as against fifteen replications of Herning. An even germination was obtained on all plots, but at thinning-time the commercial varieties were farther ahead in growth than the Herning. At the date of weighing the various plots it was quite obvious that the Herning swede was much freer from club-root than any of the other varieties (see Fig. 1). In places the commercial varieties were completely destroyed. Although a number of the Herning swedes were affected with club-root the disease did not appear to seriously incapacitate the plants, which, relatively speaking, afforded an abundance of edible material. This trial was of an extremely severe nature, the block having been sown down to swedes in each of the three years preceding the trial, and it is amazing that any swedes at all grew on that particular area. The results of this trial were as follows:—

Table 4.

Varieties.	Yield in Tons per Acre.	Average Number of Roots examined per Plot.	Percentage affected with Club-root.
Herning	15·8	66·27	54·4
Commercial W	1·7	24·0	94·6
Commercial S	2·7	25·0	86·8
Commercial E	4·7	35·6	90·4

It should be noted in regard to this trial that although the Herning swede had 54·4 per cent. of roots infected with club-root, as against 86·8 per cent. in the case of "Commercial S," the number of roots examined in the former case was appreciably more, because many roots of the other varieties had been killed off in the early stages by the disease. The percentage of plants affected after germination would thus be much higher in the case of "Commercial S," "W," and "E" than the figures in the table indicate.

FIG. 1. HERNING SWEDE AT GORE EXPERIMENTAL AREA SHOWING RESISTANCE TO CLUB-ROOT.

The two centre drills are Herning growing in badly club-rooted ground. On either side are two drills each of well-known commercial varieties which have succumbed to club-root attack.

FIG. 2. HERNING SWEDE AT WINTON EXPERIMENTAL FARM.

The two central drills are Herning, showing resistance to club-root in infected ground. Here, again, two drills of commercial swedes on each side have failed to withstand the attack of the disease.

[*Photos by E. Bruce Levy.*

During the same season a confirmatory trial was carried out at the Winton Experimental Farm, and results comparatively similar to the foregoing were obtained (Fig. 2).

As a result of these trials no doubt was left in the writer's mind that at last a strain of swede had been found which was definitely superior to the ordinary commercial varieties in club-root resistance. It has to be borne in mind, however, that this variety is not immune to club-root. It would appear that there is ample scope for improving the existing Herning strain by further selection, and this is work which undoubtedly should receive earnest attention.

YIELD TEST.

It had been suggested that resistant strains of swedes were poor yielders and unpalatable to stock. During 1928 these points were investigated, and the Herning swede was sown in competition with a number of commercial varieties on the property of Mr. K. Rodger, Tapanui. In this trial the Great Crop variety of swede was used as a control. The experiment was laid down on 12th December, 1928, and the resultant crop harvested on 11th June, 1929. All varieties of swedes were sown at the rate of 1 lb. per acre, with a mixture per acre of superphosphate 2 cwt., blood-and-bone 1 cwt., and carbonate of lime 2 cwt. The yields given in the table below are the average of six weighings in a single row.

Table 5.

Variety.	Yield per Acre.	Difference from Control.	Variety.	Yield per Acre.	Difference from Control.
	Tons.	Tons.		Tons.	Tons.
Great Crop ..	26·9	..	Great Crop ..	32·4	..
Superlative ..	30·0	+4·0	Abundance ..	31·8	— 0·6
Masterpiece ..	28·4	+0·9	Commercial E. ..	11·7	−17·4
Great Crop ..	27·5	..	Great Crop ..	29·1	..
Crimson King ..	26·6	−0·8	Up-to-date ..	30·3	+ 1·2
Imperial ..	24·8	−3·1	Buffalo ..	30·4	+ 1·5
Great Crop ..	28·0	..	Great Crop ..	28·9	..
Elephant ..	26·3	−1·6	Monarch ..	29·0	+ 0·09
Champion ..	28·8	+1·9	M. J.	29·2	+ 2·08
Great Crop ..	26·8	..	Great Crop ..	27·1	..
Magnum Bonum	30·5	+3·7	Hunsballe ..	25·4	— 1·7
Balmoral ..	28·7	−3·7	Herning ..	33·3	+ 4·4
			Great Crop ..	29·0	..
			A. Q.	34·5	+ 5·5

From this table it will be observed that Herning gave the second highest yield, thus proving that this variety is quite capable of more than holding its own as a cropper in competition with commercial varieties.

PALATABILITY TEST.

In order to test the palatability of Herning the experimental block on Mr. Rodger's farm was divided into three breaks, each of which included six drills of the several varieties, and forty wethers were used to feed these off. The observations made are presented in Table 6.

Table 6.

Order of Preference.	Break 1: Fed off 18th July.	Break 2: Fed off 15th August.	Break 3: Fed off 9th September.
1st	Hunsballe ..	Herning	Up-to-Date.
2nd	Magnum Bonum ..	Up-to-Date ..	Herning.
3rd	Monarch	Magnum Bonum ..	Magnum Bonum.
4th	Herning	Hunsballe ..	Monarch.

This trial clearly indicated that Herning swede was quite palatable to stock, both in early and late feeding. Confirmation as regards the palatability of Herning was also afforded by a trial on the farm of Mr. A. W. Taylor, Wallacetown, in which five varieties of swedes—Grandmaster, Superlative, Masterpiece, Elephant, and Herning—were sown. Ewes turned on to this block showed a decided preference for the Herning swedes, these being completely topped before any of the others were touched.

Summary of Otago and Southland Trials.

(1) Burnt lime, using various quantities up to 16 tons per acre, while not a completely effective means of controlling club-root, has appeared to generally lessen the incidence of the disease after the lapse of two years from the time of application. Further work in this connection is desirable.

(2) Bangholm Purple-top swede and Irvine's Green-top Yellow turnip have given distinct promise of being relatively resistant to club-root. Further trials with Irvine's turnip are warranted.

(3) Bangholm Improved Purple-top Herning strain swede has proved superior to the original Bangholm not only in regard to shape, rooting-capacity, palatability, and yield, but also in regard to club-root resistance.

(4) Herning swede is only resistant to a certain degree. It is not immune, but on badly infected club-rooted land a crop can be obtained by using it when other commercial varieties may fail.

(5) Further trials with Herning swede are desirable, with a view to improving its resistant character by selection.

(6) The growing of certified improved Herning swede seed in New Zealand is warranted and should prove of great economic importance.

Quality of New Zealand Butter.—The annual report of the Dairy Division for 1929–30 states that despite the large increase in production, the quality of creamery butter has probably never previously reached so high a uniform standard of excellence, the average grade for the year being 92·96, as compared with 92·84 for the previous year. Butters scoring Finest exceeded the preceding year's figures by 4·5 per cent., the totals being 74·41 and 69·91 per cent. respectively. The percentage of First grade was 25·09, as compared with 27·82 per cent., and under First 1·5 and 2·27 per cent. respectively. "Soda" flavours have been rarely commented upon, and the highly uniform character of the body and texture, together with the even distribution of the moisture content and greater attention paid to the better packing and finish of our butters, is a testimonial to the excellent team-work of the factory staffs.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTAL WORK BY THE FIELDS DIVISION.

(Continued.)

A. W. HUDSON, Crop Experimentalist, Plant Research Station, Palmerston North, and A. Y. MONTGOMERY, late Assistant Crop Experimentalist.

PART II. OBSERVATIONAL EXPERIMENTS WITH LIME, PHOSPHATE, POTASH, AND NITROGEN, 1928-29 AND 1929-30.

THESE experiments constituted a plot survey of Canterbury. Approximately two hundred plots were laid down, distributed as shown in the sectional maps. Fig. 2 shows the type of experiment used, and it will be noticed that each treatment is in duplicate. One series of plots was fenced and grazed under the system of intermittent or rotational grazing, while the other series was under the same management as the remainder of the paddock in which the experiment was situated. The system adopted had been practised on a small scale on Banks Peninsula in 1927, although the treatments under trial were different, as will be presented in Part III.

The objects of the experiments were as follows :—

(1) To determine the response to lime, phosphate, potash, and nitrogen in the various districts and soil-types of Canterbury which were under arable farming.

(2) To determine the effect of regular applications of phosphate, potash, and nitrogen on limed and unlimed ground, on the composition of the different swards under trial, and on the persistency of the species constituting the swards.

(3) To determine the effect of the treatments used under (*a*) a system of intermittent grazing and (*b*) the system as normally practised on the particular farm—which might be anything from a near approach to intensive rotational grazing to quite haphazard grazing and control of pasture.

(4) To determine the duration of the visible effect from a dressing of 1 ton of carbonate of lime per acre.

It is obvious that manure responses could not be measured on an economic basis, but it was practically certain that in a good many cases the results would be so definitely in favour of or against a particular treatment that reasonably safe conclusions could be drawn regarding its economic value. On the other hand, it was realized that in a number of cases there would be responses to the treatments applied, but on account of the smallness of the responses, coupled with naturally low fertility, the question as to whether the treatments paid or not would be extremely doubtful.

PLAN OF STANDARD EXPERIMENT.

Fig. 1 shows the standard plan adopted for this series of experiments. It will be seen that the total area occupied by each experiment is 2 chains by $1\frac{1}{3}$ chains, and that individual plots are $\frac{1}{3}$ chain or 22 ft. square.

Where *observation* of effect of treatments is all that is required, small plots have a very decided advantage over large ones for the following reasons: (1) A uniform sward can be selected on which to lay down the plots; (2) on account of their close proximity to one another treatments can be compared readily; (3) where treatments affect

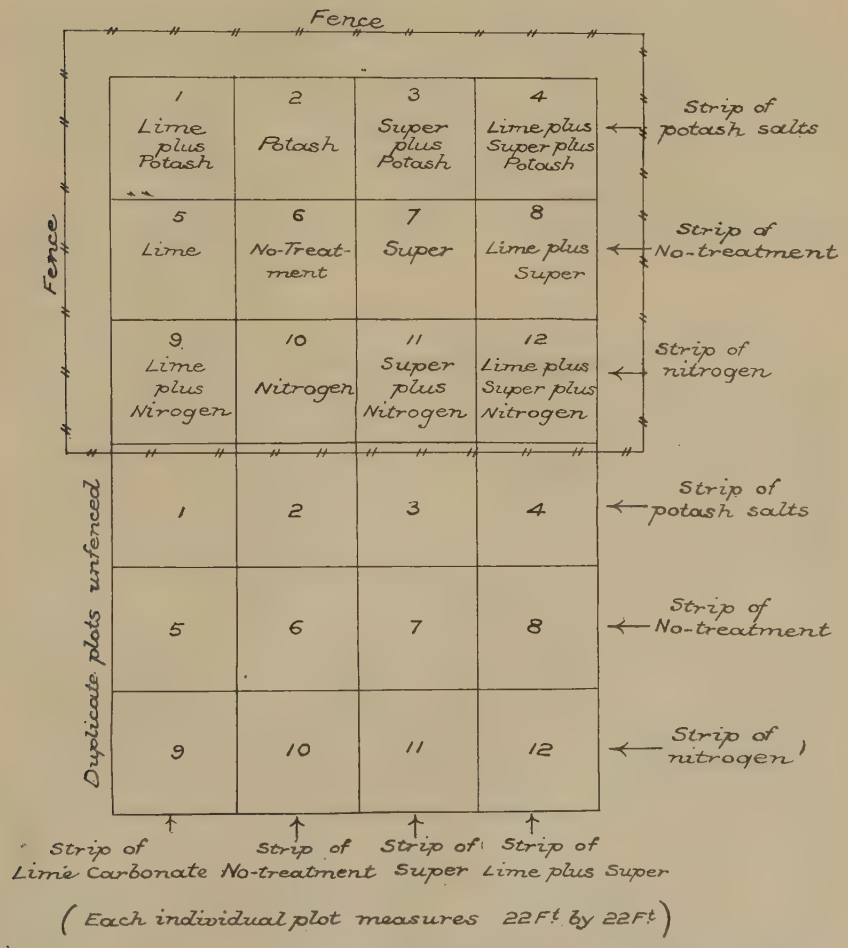

FIG. 2. PLAN OF STANDARD EXPERIMENT ADOPTED FOR THE CANTERBURY SURVEY.

palatability, as evidenced by different intensities of grazing by stock, such effect is just as clearly marked on plots of a few yards square as when plots are several chains or acres in extent; (4) where a manure-response survey is being conducted a very large number of experiments can be laid down with a comparatively small expenditure of money and time; (5) a large number of small experiments serve the interest of a greater number of farmers than a few large-scale ones.

There is no particular reason for making plots $\frac{1}{3}$ chain square; generally speaking, it is probably more convenient if they are an even fraction of an acre, such as $\frac{1}{100}$ or $\frac{1}{200}$. In a new series of experiments which aim at a survey of New Zealand in the same way as has been done in Canterbury the size of the individual plot is 25 links by 20 links = $\frac{1}{200}$ acre.

Manuring Programme.

In deciding on the quantities of manure per acre the question of whether the rate of application was an economical one for each particular soil-type was not considered. The chief point to be decided was, Did the particular treatment have any effect? Consequently reasonably heavy dressings were adopted.

The quantities applied in 1928 were as follows:—

(1) Carbonate of lime (ground limestone) ..	1 ton per acre.
(2) Superphosphate (44/46% tricalcic phosphate)	3 cwt. per acre.
(3) 30% potash salts	2 cwt. per acre.
(4) Sulphate of ammonia	3 cwt. per acre (three applications of 1 cwt. each).

The initial dressings were made during the winter and early spring of 1928. In the case of sulphate of ammonia a second dressing of 1 cwt. per acre was applied about November–December, and a third dressing about March–April of 1929. (Note.—Nitrate of soda was used for the first dressing of nitrogen in a number of the experiments.)

In 1929 no further application of lime was made, but fertilizers were used as follows:—

Superphosphate	2 cwt. per acre.
30% potash salts	2 cwt per acre.
Sulphate of ammonia	2 cwt. per acre (two applications of 1 cwt. each).

As far as possible, applications of super and potash were made in the autumn (March–April), although a good many experiments could not be dressed until May and June. The experience in 1928 indicated that the November–December application of sulphate of ammonia did temporary harm rather than good when conditions were dry. Usually, too, there was a superabundance of grass at this time and a further stimulation of growth could serve no particular object, consequently the application of nitrogen was confined to the July–August dressing in 1929 and the March–April one in 1930.

In 1930 a number of trials have had to be abandoned on account of the pastures having run out, necessitating ploughing up. However, a good proportion are being continued under the same top-dressing programme as in 1929. In light of the work conducted on rye-grasses by Messrs. Levy and Davies, as referred to in Part I, it seems reasonably certain that the rapid deterioration of pastures in Canterbury is due to the type of rye-grass used. The replacing of the present Canterbury strains by certified perennial rye-grass will undoubtedly lead to the maintenance of a much better sward in the second and subsequent seasons in the life of the pasture. Under such conditions manuring will be more profitable, for instead of manuring to induce volunteer growth, manuring will be applied to persistent constituents which were actually sown.

Distribution of Experiments.

All Farmers' Union branches throughout Canterbury were invited to co-operate in the experimental scheme, and the majority assisted materially by submitting names of farmers willing to provide paddocks on which experiments could be laid down. Approximately five experiments were arranged for in each local district. The location of the experiments was indicated by the general map printed with Part I in last month's *Journal*, and larger-scale district maps accompany the detailed results appended to the present Part II.

In the detailed notes the experiments are arranged according to Farmers' Union districts, and following the notes on each district a brief summary is made in which in some cases an opinion is expressed regarding the payable nature of the manure responses. The notes are a very brief résumé of all observations made over a period of about two years. It is impossible to discuss each individual experiment in detail, and readers are reminded that while the effect of a manure might be very striking at one time of the year at another time no visible effect would be apparent.

Discussion of Results.

(1) Responses to Lime and Manures.

The following table summarizes the responses from the major treatments and combinations of treatments used. The percentages of the trials falling in each of the classes from "No visible response" to "Excellent response" are shown. A full explanation of the system of classifying responses is given in the notes preceding Appendix A.

Table 1. Percentages of Responses to Major Treatments in the Experiments which fall in the various Response Classes.

Treatment.	Degree of Response to Treatment.							Total Number of Experiments in which Treatment was used.
	No Visible Response. (0)	Doubtful Response. (?)	Slight Response. (1)	Fair Response. (2)	Good Response. (3)	Very good Response. (4)	Excellent Response. (5)	
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	
Lime ..	5	5	29·5	28·5	26	6·5	..	201
Super ..	5	3·5	26·5	33	24	7·5	1	201
Lime plus super	2	4	6·5	12	23·5	23	29·5	201
Potash ..	83·0	7	4	3·5	2	..	..	196
Nitrogen ..	0·5	1	4·5	30	51·5	12·5	..	193

Comments on Responses to Treatments.

Lime.—Hitherto lime has not been viewed as an important limiting factor to the production of pasture in Canterbury. These experiments show only 5 per cent. of cases in which there is "no visible response." The 5 per cent. of "doubtful responses" include experiments which have been down for one year only at the time of writing. A "slight response" is recorded in 29·5 per cent. of cases, while "fair to very good" responses are represented by 61 per cent. of the trials. From the point of view alone of

increased benefit to stock in supplying lime through medium of the pasture the writers are of the opinion that its use is justified in practically all Canterbury soils.

In many places the increased growth of herbage, especially where superphosphate was used in addition, leaves no doubt in our minds regarding the economic value of liming from the production aspects. It is of interest to note that some of the highest responses to lime have occurred on the light to medium soils overlying shingle, such as those in the vicinity of Sherwood and Lauriston in Ashburton County.

Duration of effect of lime: Experience from plots which have been down for several years on high-lime-response country indicates that the visible effect of a dressing of 1 ton of carbonate of lime per acre should extend over a period of five or six years at least (see Fig. 4, App. A). Smaller quantities should give results which are more or less proportionate to the amount applied. The present series of experiments has not been down sufficiently long to enable general conclusions regarding the duration of effect from lime to be determined on them. On some soils the effect of lime was visible four to five months after application, and, generally speaking, the effect was much more marked in the second year than the first.

Superphosphate.—"No visible response" to super is recorded in 5 per cent. of the trials, while 3·5 per cent. are in the "Doubtful response" class, 26·5 per cent. are recorded as "Slight response," 33 per cent. under "Fair response," and 24 per cent. under "Good." The "Very good" and "Excellent" classes are represented by 7·5 per cent. and 1 per cent. of cases respectively.

In the cases of both lime and super the classification of responses is made more or less relative to the responses from the combination of lime plus super. Consequently the responses to the individual treatments appear relatively smaller—as was actually the case—than the responses from the combination lime plus super.

In many of the experiments on the very light lands "fair" and in some cases "good" responses can hardly be paying. It is noteworthy that on this class of land the use of super *drilled into the ground at the time of sowing* with any crop, including grass, is undoubtedly paying. The use of super as a top-dressing on established grassland is, however, not productive of sufficiently good results to encourage one into thinking that it can be profitable, on the typical lower-rainfall areas at least. Some method whereby super can be actually placed in the soil to a depth of 2 in. to 3 in. may give much better results, and is certainly worth trying.

Lime plus Superphosphate.—The effect of the combination of lime and super has been an outstanding feature of the trials. Almost without exception the combination has proved superior to either material alone. In about 10 per cent. of the trials no visible response from one or other of the individual treatments was discernible, but when combined a distinct response has been noted.

In only 2 per cent. of cases is "no visible response" recorded. In 76 per cent. of the trials the lime plus super plots are fairly evenly distributed over the "Good," "Very good," and "Excellent"

response classes, slightly more being recorded under "Excellent" than in either of the other two classes mentioned.

The importance of the lime plus super combination in connection with the establishment and maintenance of pastures of short or long duration cannot be stressed too strongly. Experience indicates that rye-grass responds almost as well as clovers, if not quite as well, to the addition of lime to soils deficient in it. The duration of effect of lime was discussed above, and the argument that liming is expensive cannot be admitted when it is remembered that the effect of a dressing of about a ton will continue for five or six years. It is obvious that the best results cannot be got from super if lime is deficient.

Potash.—The results obtained indicate that in the main potash is not a serious limiting factor to pasture production in Canterbury; 83 per cent. of the experiments showed no visible response to potash, in 7 per cent. the response was "doubtful," in 4 per cent. "slight," and in 2 per cent. "good." Where responses did occur they were most marked as a rule where the potash plot crossed limed ground. The claim that potash, though ineffective in improving yield, has a marked effect on the quality and feeding-value of grass herbage has not been substantiated so far as the writers are aware.

Nitrogen.—Responses to nitrogen were particularly consistent, over 80 per cent. of the experiments falling in the "Fair" to "Good" classes so far as this factor was concerned. Generally speaking, the better the rye-grass and cocksfoot content of the sward the better the response to nitrogen. The best results, too, were obtained where the nitrogen plot crossed lime plus super, although very often the super plus nitrogen plots were good.

In practically all experiments the best plot of the series was that receiving lime plus super plus nitrogen. It must be remembered, however, that from the commencement of the trials until May, 1930—just under two years—most of the experiments had received 5 cwt. of nitrogenous fertilizer per acre, at a cost of about £3 5s. per acre. In addition to the period of two to three months after application, when the nitrogen exercised a direct influence, there has been a general improvement in the grass sward. The growth of clover has been reduced in a good many cases, but as a rule the reduction in clovers did not appear to be serious on the lime plus super plus nitrogen plots. We do not venture an opinion as to whether or not the use of nitrogen at its present price is paying. This must depend on a number of factors; but one thing is certain —namely, that nitrogen will not pay on pastures which are lacking in the major species of grasses—rye-grass and/or cocksfoot.

To those farmers who desire to try nitrogen, our advice is: (1) Use it on pasture which has been limed and phosphated; (2) use it only for the production of early spring grass by applying it in late July or early August, and possibly for production of early winter feed by applying in March or April; (3) use it on good pastures only; (4) feed off the resultant growth while it is still young and palatable. These remarks apply only to pastures used for grazing purposes.

(2) EFFECT OF TREATMENTS ON THE COMPOSITION OF SWARDS AND PERSISTENCY OF SPECIES.

Most of the experiments were laid down on newly sown or comparatively young (one or two years old) pastures. The use of the three to five years' duration pasture rendered this desirable in order to ensure continuity for a few years. The scope of this report does not allow the individual pastures to be discussed in detail, nor is it particularly desirable to do so, as composition of the sward on arable land is largely governed by species and strains sown and subsequent management. It is well known that pastures "run out" rapidly in Canterbury. The recent researches of Levy and Davies, referred to earlier, have shown that strain of rye-grass has an important bearing on this rapid deterioration. Where rye-grass was the main constituent of the newly sown and younger pasture, generally speaking, it died out rapidly even under the better manurial treatments, although to a lesser extent on these than on the lesser effective treatments and the no-manure plots. Consequently the treatments were largely dependent on volunteer suckling clover and white clover, and such grasses as sweet vernal, brown top, Poa annua, and Yorkshire fog, as subjects for their action. The result was that, instead of increasing with continued application of fertilizers, responses were often less in the second year than in the first so far as grasses particularly were concerned.

Once again we desire to stress the fact that maximum effects from manures can be obtained only when a covering of high production and persistent species is present for the utilization of the manures applied. Lime, super, and lime plus super usually showed a greater influence on clovers than on grasses, although where rye-grass and cocksfoot and crested dogstail were present in fair amount lime plus super often had a marked influence on their production (Fig. 8, Appendix C).

Where potash effect was noted its main influence was on clovers. Nitrogen invariably stimulated grass-growth, and the greater the amounts of rye-grass, cocksfoot, and dogstail present the better was the response from it. It materially increased the growth of all grass species, but, as a rule, the material which it had to work on was of an inferior type. Suppression of clover-growth was a fairly constant feature accompanying the use of nitrogen, although, as stated previously, this did not appear to operate to a serious extent on those plots which had lime and phosphate in addition.

(3) SYSTEM OF GRAZING.

This falls under two categories—(*a*) intermittent controlled grazing of enclosed areas; (*b*) grazing under ordinary practice of the particular farm.

Unfortunately, only a small proportion of farmers were able to graze the enclosed section of the trial on a strictly intermittent system of utilization at an appropriate stage. Often the areas were too far from the homesteads and were neglected in busy times. Where proper control was exercised the pastures benefited considerably. Cocksfoot showed itself to be a grass which did well under such conditions. Where growth was allowed to become rank the pasture generally suffered as a consequence, and rapid opening up took place. One of

the difficulties in stocking the fenced areas was to know just when to put stock on. At certain seasons the nitrogen plots had a good growth before the remainder of the plots were ready to graze. Usually stock were withheld until some of the slower-growing plots were ready, with the result that the nitrogen-treated plots were too rank for sheep and were neglected, while the other plots were grazed hard. So long as the nitrogen plots were grazed at a reasonably short stage of growth the sheep ate the herbage as readily as with any other treatment, more especially where the nitrogen crossed the super and super plus lime.

EFFECT OF TREATMENT ON PALATABILITY OF HERBAGE.

The lime plus super plots were almost always the most closely grazed (see Fig. 9, App. C), although it was sometimes difficult to distinguish between lime plus super and super alone from this point of view. Plots receiving lime alone were also closely grazed in a good many experiments. The closeness of grazing of nitrogen-treated plots was almost entirely governed by the stage of growth at which grazing occurred. When utilized at a young stage (2 in. to 3 in.) plots receiving nitrogen in addition to lime plus super, super, or lime were invariably well grazed. If grazing was delayed beyond this stage the nitrogen-treated plots were generally neglected, with the result that a big bulk of unconsumed roughage accumulated on them. Sheep were used for grazing in nearly all the experiments.

WHEN TO APPLY MANURES.

Time of application, except in the case of nitrogen, was not investigated particularly. There is abundant evidence, however, to indicate that early autumn application on established and well controlled pasture should be the best for lime and super. A certain amount of autumn, winter, and early spring growth will result, with a good response later in the season. If application of these manures is delayed until late winter or early spring there is likely to be a big stimulation during what is the normal high-production period, and difficulties of management and utilization are accentuated. As stated earlier, the most promising times at which to apply nitrogen which gives results within one or two months after application are late July or early August for early spring growth, and March to April for late autumn growth.

It is well to remember that manuring for increased production in naturally low-production periods is much better than manuring for increased production in naturally high-production periods. "Renovation" of pastures is a wrong practice. "Maintenance" of fertility and management from the time the pasture is sown is what should be the aim of every farmer.

The Appendices.

Readers who are not particularly interested in the individual experiments are advised merely to look through the illustrations in the appendices. The results presented therein are for the guidance of farmers in the districts to which they refer. As a record for the guidance of farmers and those people whose duty it is to advise farmers the detailed results should be of considerable assistance.

Summary of Part II.

(1) The report discusses the results from observational experiments in which about 200 pastures were top-dressed with lime, superphosphate, potash, and nitrogen in the seasons 1928–29 and 1929–30.

(2) The combined lime plus super treatment has been outstanding in effect, definite responses being recorded in 94 per cent. of the trials. In 76 per cent. the responses are classed as good to excellent.

(3) Potash has had no visible effect in 83 per cent. of the trials, and does not appear to be an important factor in Canterbury, except in a few isolated places.

(4) Nitrogen caused increased growth of grasses in about 98 per cent. of the trials, being most beneficial when applied to ground treated with lime plus super. It almost invariably depressed clover-growth, although not to a serious extent when combined with the lime plus super application. The lime plus super plus nitrogen plots almost always had the best sward.

(5) Most of the pastures under trial ran out very rapidly. This is considered to be due to the poor strain of rye-grass in use.

(6) Where intermittent grazing was carried out effectively the pastures were improved. Under poor and inefficient utilization the pastures deteriorated more rapidly.

(7) Lime, super, and lime plus super generally had a marked effect on the palatability of the herbage.

(8) Application of lime and super in the early autumn is recommended in established pastures. Maintenance of good pastures, and not renovation of run-out pastures, is strongly recommended.

Notes on Interpretation of Results as Recorded in Appendices.

The first column indicates the number of the experiment as shown on the related section map. In columns 3 to 7 inclusive points are awarded to indicate the nature of the response to the treatment named at the head of each column.

0 = No visible response.	3 = Good response.
? = Doubtful response.	4 = Very good response.
1 = Slight response.	5 = Excellent response.
2 = Fair response.	

In some cases the effect of lime alone or super alone may not have been discernible with certainty, but lime plus super may have given a decidedly better response than either lime alone or super alone. In such cases one point followed by a plus sign (+) is given to the treatment in doubt.

The object of this system of recording results is to enable the information collected to be recorded concisely. In a number of cases both lime alone and super alone may receive 3 points each, whereas lime plus super will receive only 5. In such cases it may be taken for granted that the combined effect of the treatments is practically equal to the sum of the individual treatments.

Where other treatments—nitrogen or potash—are awarded points it may be taken as a rule that these points represent responses in

addition to those already scored for lime, super, or lime plus super. Points do not represent money values. On naturally good land a good response may indicate a high potential return, whereas on naturally poor land a good response may be obtained, which, however, may not be payable.

CLASSIFICATION OF SOILS.

It was not feasible to obtain chemical or mechanical analyses of the soils on which the experiments were conducted. An endeavour has been made to indicate the soil-type more or less according to the classification used by the Chemistry Section of the Department of Agriculture. It must be understood that the application of this system of classification here is entirely on surmise, except in a few cases where mechanical analyses have been made, and only major types are considered, each soil being placed in the class to which it is considered it falls nearest. The soil-types are shown in column 8 of the appendices.

The classes used are as follows:—

(*a*) Fine sandy silt: Contains more than 40 per cent. fine sand, from 20 to 50 per cent. silt, fine silt, and clay; usually 10 to 35 per cent. silt and fine silt, and less than 5 per cent. clay.

(*b*) Fine sandy loam: Contains 20 to 50 per cent. silt and fine silt and clay; usually 10 to 35 per cent. silt and fine silt; usually 5 to 15 per cent. clay.

(*c*) Silt: Contains more than 50 per cent. silt and fine silt; less than 5 per cent. clay.

(*d*) Silt loam: Contains more than 55 per cent. silt and fine silt; 5 to 25 per cent. clay.

(*e*) Loam: Contains more than 50 per cent. silt, fine silt, and clay; and less than 55 per cent. silt and fine silt; usually 15 to 25 per cent. clay.

(*f*) Clay loam: Contains more than 60 per cent. silt, fine silt, and clay; 25 to 55 per cent. silt and fine silt; 25 to 35 per cent. clay.

It is considered that the foregoing range of soil-types covers those met with in the experiments. Where the soil is stony this will be noted after the letter indicating the soil-type; for example, a fine sandy silt with stones is described as "*a* (stony)."

APPENDICES.

A.—Responses to Treatment in Experiments north of Ashley River. (Map Section 1.)

Table 2.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Waiau District.						
1	A. Baker	2	3	4	0	3	*e.*
2	J. Belton	2	2	4	1	3	*e.*
3	G. White	2	3	4	2	4	*e.*
4	MacDougall Bros.	2	1	3	0	3	*e.*
5	J. Brown	2	4	5	?	4	*c.*

Table 2—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Culverden District.						
6	E. Roberts	1	3	4	0	2	*a* (stony).
7	J. Black	1	4	5	0	Not used	*a* (stony).
8	H. A. Ingram	1	3	4	0	1	*c.*
9	J. V. Harrison (1)	1	1	3	0	3	*a.*
10	J. V. Harrison (2)	3	3	5	0	4	*a.*
	Cheviot District.						
11	Mrs. Thomson, Spotswood ..	2	2	4	0	3	*e.*
12	A. G. Harrison, Spotswood ..	3	3	5	Not used	..	*e.*
13	D. Milne, Phœbe	3	1	3	0	2	*e.*
14	A. McGiffert, Mina* ..	3	1	5	Not used	..	*e.*
15	G. W. Forbes	4	2	5	2	2	*e.*
16	J. Paton, Domett	3	1	5	0	4	*e.*
17	E. Ayrton, Domett* ..	0	0	1	Not used	..	*e.*
18	H. Geeson, Domett.. ..	3	2	4	0	3	..
	Waipara-Omihi District.						
19	H. B. Inch	3	2	4	0	3	*d.*
20	E. Foster	3	1	4	2	2	*d.*
21	W. McAlpine	3	2	4	0	2	*d.*
22	W. Baxter, Spye	1	1	2	0	3	*d.*
23	C. Harris	1	2	2	0	2	*d.*
	Scargill District.						
24	G. W. Pannett	2	2	3	2	3	*c.*
25	H. V. Murray	1	2	3	0	2	*b.*
	Waikari-Hawarden District.						
26	H. Fincham	1	3	4	0	2	*e.*
27	H. Heasley, Hawarden ..	1	3	4	0	4	*a* (stony).
28	H. D. Burt, Hawarden ..	0	1	1	0	1	*f.*
29	W. E. Johnston, Woodgrove	1	3	4	0	3	*e.*
30	W. T. Earl, Woodgrove ..	1	1	2	0	2	*e.*
	Amberley-Leithfield-Sefton District.						
31	D. McLean, Amberley ..	0	0	1	0	1	*e.*
32	T. F. Croft, Amberley ..	1	2	3	0	2	*e.*
33	S. H. Gardiner, Amberley ..	1	5	5	0	3	*e*
34	McLean Bros., Amberley ..	1	1	2	0	1	*e.*
35	J. S. Russell, Leithfield ..	1	1	2	1	1	*e.*
36	F. J. Douds, Amberley ..	2	2	3	0	2	*e.*
37	C. King, Loburn (formerly H. Barker)	3	3	4	0	3	*f.*

*See haying trial report in this *Journal* for April, 1927.

COMMENTS ON TABLE 2.

Waiau District.—Lime plus super gave outstanding results. Where rye-grass was in abundance nitrogen gave good results, especially on plots receiving lime plus super. Potash had an influence mainly on clover-growth in two experiments. Experiments 1, 2, 3, and 4 are on downs

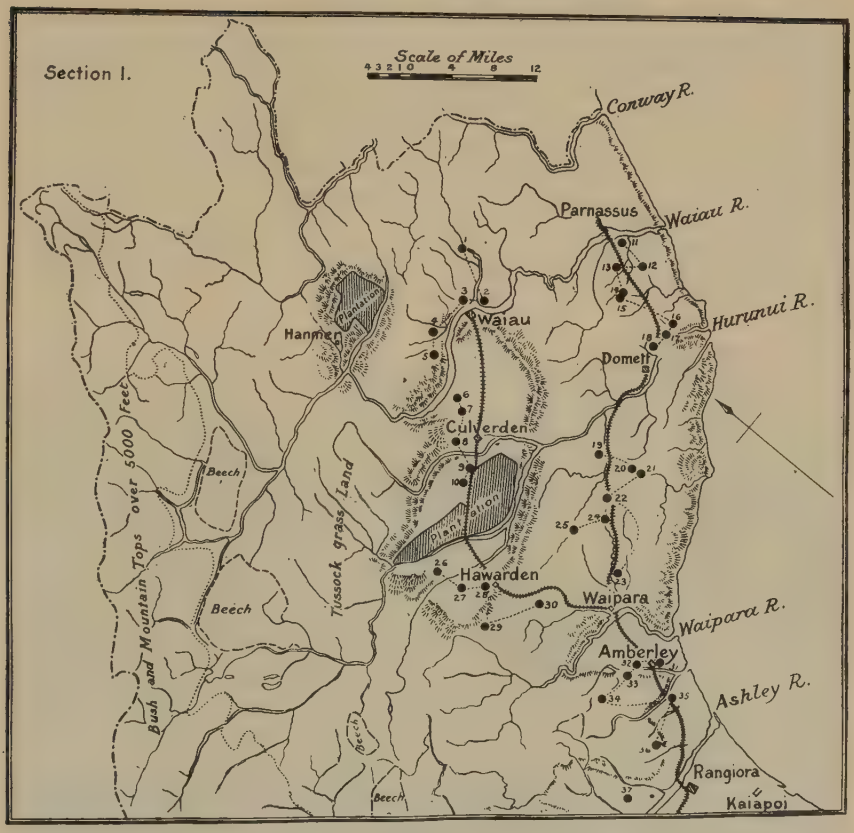

FIG. 3. MAP OF SECTION I, SHOWING LOCATION OF EXPERIMENTS NORTH OF ASHLEY RIVER.

Each experiment is represented by a numbered dot.

country, the soil being a loam. Experiment 5 is on river-flat country, the soil being of a silty nature. Most of the pastures have run out badly except on the best plots. The use of lime plus super should pay well in this district providing it is applied to good pastures.

Culverden District.—Lime plus super has proved a very satisfactory combination, and on Experiment 10 nitrogen gave very good results on the lime and super plots. In Experiments 6, 8, 9, and 10 lime plus super plus nitrogen were the best plots. Stock showed marked preference for lime plus super in most cases. Lime plus super should pay well in this district, particularly if used at time of sowing pasture.

Cheviot District.—With the exception of Experiment 17, lime is of outstanding effect in this district. Super alone gave slight to fair results, which are considerably enhanced when super is used on limed ground. It is not a question of whether lime plus super pays in this district. They are both absolutely essential to the production of pasture. Potash had no visible effect except on Experiment 15, and then only on limed ground. Most of the experiments are on downs country. It is now six years since Experiment 14 was laid down. The effect of lime was still very marked in the spring of 1929 (see Fig. 4).

Waipara-Omihi District.—In these experiments a good lime response is indicated. Generally speaking, lime plus super is better than either lime or super alone, and the best plot is lime plus super plus nitrogen in all cases. Potash gave fair results in Experiment 20, this being first noticed in the autumn of 1930. In Experiment 21 the response to lime plus super is very good, but the pasture is a tussock-danthonia one, and suckling clover has been responsible for the chief response, which is not likely to be payable.

Scargill District.—Responses were not very outstanding, although lime plus super gave good results in both experiments. Response from potash was not noticeable in Experiment 24 until March, 1930, and then its effect was on red clover growth.

FIG. 4. EXPERIMENT ON FARM OF A. MCGIFFERT, MINA, CHEVIOT DISTRICT (NO. 14).

On left, no treatment; on right, lime carbonate, at 1 ton per acre, applied in winter of 1924. Photo taken in October, 1928, when the lime and superphosphate plots had a much denser sward of rye-grass and clover and were better grazed than the no-treatment plot.

Waikari-Hawarden District.—Super, and lime plus super gave satisfactory response in three trials only. Nitrogen was effective only when a reasonable amount of rye-grass was present. Experiments 27, 28, and 30 have been ploughed up on account of the pasture having run out. Experiments 28 and 30 are on soil which has a reputably small phosphate-response on any crop.

Amberley-Leithfield-Sefton District.—The almost entire absence of response in Experiment 31 is largely due to the very inferior pasture. No outstanding response occurred from lime except in Experiment 37. Results from super are not striking except in Experiment 33. Lime plus super was generally superior to lime or super alone. The relatively poor nitrogen response is no doubt due to a comparatively poor type of pasture in some cases. Experiments 31 and 34 have been ploughed up.

Summary of Experiments North of Ashley River.

Lime.—Only three out of the thirty-seven experiments failed to give a noticeable response from lime. In one of the three (No. 31) lime plus super gave a slight effect. The most striking responses occurred in the Cheviot district, although good responses also occurred in the Omihi Valley.

Superphosphate.—Only two cases are recorded where super did not show a benefit at some stage or other. Most districts gave fair to good responses, except in the Cheviot and Omihi Valley districts, where responses were generally slight to fair.

Lime plus Superphosphate.—With one exception, the lime plus super combination was superior to lime alone or super alone. In a large number of experiments a marked superiority in palatability as evidenced by closer grazing was apparent.

Potash.—Six experiments out of the thirty-seven showed slight to fair responses to potash. These results indicate that potash is not a serious limiting factor so far as production of volume of herbage is concerned.

Nitrogen.—Nitrogen caused increased growth at some period in all trials. The results can be considered good only where a good percentage of rye-grass is present in the sward. In nearly all the experiments the best results with nitrogen were obtained on ground treated with lime plus super.

B.—Responses to Treatments in Experiments between Ashley and Rakaia Rivers. (Map Section 2.)

Table 3.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Rangiora-Fernside-Waikuku District.						
1	Stoker Bros., Waikuku ..	1+	2	3	0	2	*c.*
2	C. Leech, Rangiora ..	1	2	3	0	3	*d.*
3	W. Stalker, Rangiora* ..	1	2	3	Not used	Not used	*d.*
4	J. F. Dawson, Fernside ..	3	3	4	0	3	*a* (stony).
5	Doak Bros., Rangiora ..	2	3	4	0	3	*d* (peaty).
6	W. Power, Fernside ..	1	1	2	0	2	*a* (stony).
	Kaiapoi-Ohoka-Mandeville District.						
7	J. Thacker (formerly E. Fear), Kaiapoi*	0	4	4	Not used	Not used	*c.*
8	J. D. McMullan, Kaiapoi ..	2	3	4	0	0	*d.*
9	M. Williams (1), Ohoka ..	1+	4	5	0	3	*d.*
10	M. Williams (2), Mandeville ..	1+	2	3	0	2	*a.*
	Cust - West Eyreton District.						
11	S. Smith, Cust (1)	3	1	4	0	2	*c.*
12	S. Smith, Cust (2)	Growth too rank for observation					*d* (swampy).
13	R. L. Anderson, Bennett's Jun.	1	1	2	0	1	*b* (stony).
14	F. Sheat, Horreville ..	0	0	0	0	2	*c.*
15	J. E. Burns, Horreville ..	1	1	3	0	3	*a* (stony).
16	W. S. Busch	1	1	3	0	2	*a* (stony).

* Haying trial—Part IV.

Table 3—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Oxford District.						
17	W. J. Skurr, Carlton ..	3	2	4	0	3	*a* (stony).
18	J. J. Skurr	3	3	5	2	3	*d*.
19	A. Baxter	3	3	5	0	3	*c*.
20	H. G. Cross (2)	3	3	5	0	3	*a* (stony).
21	H. G. Cross (1)	3	4	5	0	3	*b* (stony).
22	A. A. Fantham	3	3	5	0	2	*e*.
	Aylesbury-Halkett-Kirwee District.						
23	J. D. Henderson, Halkett ..	2	4	5	0	4	*b*.
24	R. Henderson, Halkett ..	1	1	3	0	3	*c*.
25	M. V. Davis, Aylesbury ..	1+	1+	1	0	2	*a* (stony).
26	A. Manson, Kirwee ..	1	1	2	0	4	*a*.
27	J. D. Penny, Kirwee ..	2	1	3	0	3	*a*.
	Lincoln-Springston District.						
28	Pearson Bros., Lincoln ..	2	1	3	?	3	*c*.
29	P. V. Bailey, Springston ..	1	2	3	0	2	*c*.
30	C. N. P. Powell, Springston ..	1+	3	5	0	3	*c*.
31	J. W. Kime (1), Springston ..	0	0	0	0	1	*a* (stony).
32	J. W. Kime (2)	0	0	0	0	1	*a* (stony).
	Motukarara District.						
33	H. Nutt, McQueen's Valley ..	1	1+	2	1	3	*d*.
	Springfield-Russell's Flat District.						
34	R. M. Johnston, Mount Torlesse	2	2	3	?	3	*d*.
35	E. P. Rushton, Springfield ..	3	3	5	0	3	*c* (stony).
36	W. McIlwraith, Russell's Flat	4	2	5	0	2	*c*.
37	D. Doody, Russell's Flat ..	3	2	5	3	3	*c*.
38	S. H. Amyes, Springfield ..	1	1	2	0	2	*d*.
	Sheffield-Annat District.						
39	L. T. Wright, Annat ..	2	4	5	0	3	*c* (stony).
40	J. H. Jebson, Sheffield ..	3	2	5	0	2	*c*.
41	D. J. Hawke, Sheffield ..	3	2	5	1	4	*c*.
42	R. J. Cullen, Sheffield ..	2	4	5	0	3	*c* (stony).
	Hororata District.						
43	F. N. Wright	0	1	1	0	2	*b* (stony).
44	W. R. Oliver	1	2	3	0	3	*e*.
45	J. Ballagh	1+	1	3	1	3	*e*.
46	Bruce Bros., Coleridge Road..	2	4	5	3	3	*a* (stony).
	Te Pirita-Mead Settlement-Bankside District.						
47	A Craig, Te Pirita	1+	3	4	0	3	*a* (stony).
48	E. Duncan (1), Te Pirita ..	1	2	3	0	2	*a* (stony).
49	E. Duncan (2), Te Pirita ..	0	1	1	0	1	*a* (stony).
50	J. Kelso, Bankside	2	2	3	1	3	*a* (stony).
51	W. Shellock, Mead.. ..	3	3	5	3	3	*c*.

COMMENTS ON TABLE 3.

Rangiora-Fernside-Waikuku District.—Both lime and super gave consistent, though relatively small, results in general. Lime plus super was invariably better than either lime or super alone. Nitrogen responses were the best where rye-grass was fairly abundant. In Experiment 1 lime alone showed no visible effect, but lime plus super was better than super.

Kaiapoi-Ohoka-Mandeville District.—Super alone gave striking results in this district (Fig. 6). Lime plus super, with the exception of Experiment 7, was better than super. Nitrogen responses occurred where fair amounts of grass were present. Experiment 10 has been ploughed up, as the pasture was badly run out.

Cust-West Eyreton District.—No outstanding responses occurred except in Experiment 11, where lime showed itself to be a very important factor. The pasture ran out very quickly and white clover became

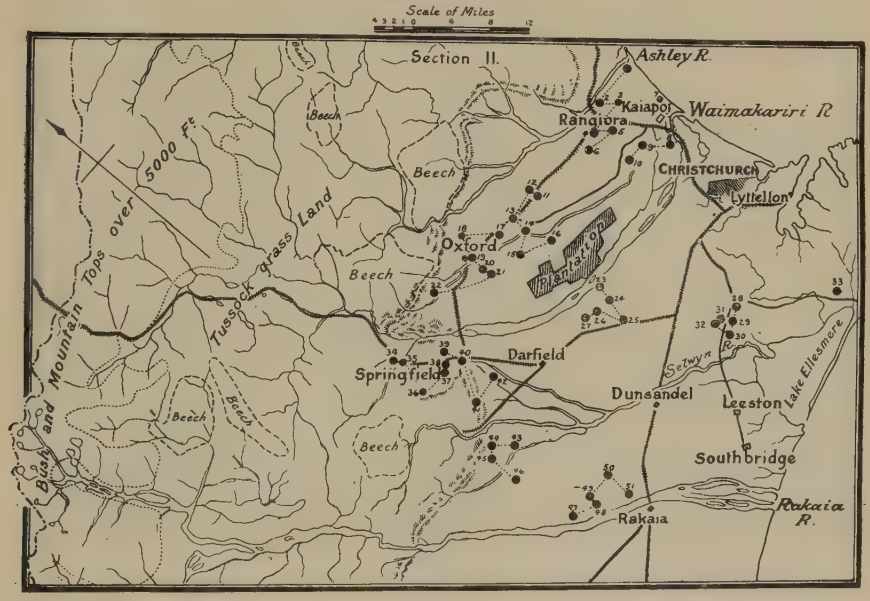

FIG. 5. MAP OF SECTION 2, EXPERIMENTS BETWEEN ASHLEY AND RAKAIA RIVERS.

dominant on the lime plots. In Experiment 14 the growth was not well controlled and observations were difficult. Experiment 15 is on very light land. Nitrogen had a marked effect on cocksfoot, especially on the lime-plus-super-plus nitrogen plot.

Oxford District.—The responses to lime and super in this district are outstanding, especially when the two are combined. In Experiment 18 potash had an influence in the second season. Nitrogen responses were generally good, but, in common with the majority of trials, the growth on the nitrogen plots was neglected. No doubt this was due to the growth being too long when the areas were stocked.

Aylesbury-Halkett-Kirwee District.—The soils in this district are, generally speaking, very light, and pasture runs out rapidly. Experiment 25 has been ploughed up. Lime plus super proved superior to lime and super

alone, but, with the exception of Experiment 23, no outstanding responses were obtained. Nitrogen did well where good grasses were present. Where good grasses were absent hair-grass responded freely to nitrogen.

Lincoln-Springston District.—In the first three experiments lime and super gave slight to good results. Lime plus super has proved superior to either lime or super alone. Experiments 31 and 32 were on poor, run-out pasture, consisting mainly of hair-grass and goose-grass. Both have been ploughed up. Nitrogen response was more or less proportionate to the amount of rye-grass and cocksfoot present.

Motukarara District.—Responses here were small. The marked feature of this experiment was the big improvement in the enclosed area, notably in cocksfoot, which resulted from good rotational grazing.

FIG 6. EXPERIMENT ON FARM OF M. WILLIAMS, OHOKA (NO. 9).

The effect of super on growth of white clover, as seen in foreground, was very marked in this experiment.

Springfield - Russell's Flat District.—Lime and super were consistent, with good to excellent results when used together. Lime and phosphate are essential to good pasture-production in this district, and their use must be highly paying on good pasture. In Experiment 37 potash gave good results when used with lime and super. Nitrogen thickened up the sward considerably when used with lime plus super. On Mr. Duncan's farm a very good result was obtained from the use of 5 cwt. of ground limestone in conjunction with phosphate in a trial carried out by him.

Sheffield-Annat District.—Here again lime plus super is essential to successful pasture growth. In Experiment 41 potash showed up slightly in the second season. The plots receiving lime and super plus nitrogen were invariably the best. Experiment 42 has been ploughed up.

Hororata District.—Experiments 44 and 45 are on the clay downs of this district. In Nos. 44 and 45 lime plus super gave good results. Experiment 46 is on the lighter land along the road to Lake Coleridge. The results in this experiment were remarkable. All treatments showed responses.

Te Pirita - Mead Settlement - Bankside District.—Lime and super gave consistent results. Experiments 48 and 49 were on very light country, and the application of manures could not be payable. These plots were abandoned. Experiment 51 gave good results from all treatments in the first season. The pasture has now run out.

Summary of Experiments between Ashley and Rakaia Rivers.

Lime.—Of the fifty-one experiments recorded only six failed to show a response to lime. In the remaining forty-five lime alone showed a definite response, or (in seven experiments) lime plus super was definitely better than super. The responses were most outstanding in the Cheviot, Springfield - Russell's Flat, and Sheffield - Annat districts.

Superphosphate.—Benefits from the use of super were apparent in forty-eight of the fifty-one experiments. In two of these the effect could be noticed only in superiority of lime plus super over lime. The best responses occurred in the Kaiapoi-Ohaka-Mandeville, Oxford, Sheffield-Annat, and Springfield-Russell's Flat districts.

Lime plus Superphosphate.—Responses to lime plus super were observed in forty-eight of the experiments, and in all of these except four the lime-plus-super combination was superior to super or lime alone. The most marked results were obtained where the lime response was greatest.

Potash.—Responses to potash occurred in eight experiments. In two others a doubtful response was recorded. The response areas are not confined to particular districts. The most noticeable results occurred in Experiments 46 and 51, both of which were on land of alluvial formation. Experiment 46 was on light stony land.

Nitrogen.—Nitrogen affected growth in all the experiments but one. In the absence of rye-grass, cocksfoot, or dogstail the response was usually small. When applied to ground treated with lime plus super the results were invariably most effective, and, except in a few cases, clovers were not suppressed on plots receiving lime, super, and nitrogen. Usually nitrogen-treated plots showed neglected growth. This may be attributed to delaying stocking until growth was too far advanced.

C.—Responses to Treatments in Experiments between Rakaia and Rangitata Rivers. (Map Section 3.)

Table 4.

1	2	3	4	5	6	7	8
Reference No. on Map.	Farmer.	Lime Response.	Super Response.	Lime plus Super Response.	Potash Response.	Nitrogen Response.	Soil-type.
	Rakaia-Somerton-Hatfield District.						
1	J. Stewart, Rakaia ..	2	2	4	0	3	*c.*
2	J. F. Langley, Somerton ..	2	2	3	0	3	*b.*
3	W. Boag, Hatfield	3	2	4	0	4	*b.*
	Sherwood-Lauriston-Winchmore District.						
4	W. Goodwin (now J. Cretney), Lauriston	3	3	5	0	3	*a.*
5	F. Amos (now V. W. Boag), Lauriston	3	3	5	0	2	*a.*

Table 4—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Sherwood-Lauriston-Winchmore District—continued.						
6	H. J. Crothers, Sherwood ..	4	2	5	0	4	*a*.
7	W. Letham, Sherwood ..	4	3	5	0	3	*a*.
8	H. Morris, Winchmore ..	2	1	3	0	3	*a* (stony).
	Mount Hutt-Methven-Upper Winchmore District.						
9	D. M. Christie, Mount Hutt ..	?	?	?	?	2	*b* (stony).
10	D. Campbell, Methven ..	1+	1+	2	0	2	*b* (stony).
11	J. Watson, Upper Winchmore	1	1	3	0	3	*a* (stony).
12	R. N. Elliott, Methven ..	1	1+	2	0	2	*b*.
	Springburn-Staveley District.						
13	S. A. Allen, Springburn ..	3	1+	4	0	2	*a* (stony).
14	G. McFarlane, Springburn ..	2	1	3	0	3	*a* (stony).
15	R. A. Hobbs, Springburn ..	3	3	5	0	3	*b* (stony).
16	W. Gundry, Staveley ..	2	3	5	0	3	*d*.
17	G. Fittock, Staveley ..	1	3	4	0	2	*d*.
18	A. R. Andrews, Staveley ..	1	1	2	0	2	*d*.
	Mount Somers District.						
19	T. Rutherford	1	1	2	0	2	*b*.
20	J. Thomson	2	2	4	0	3	*a* (stony).
21	Stephen Bros.	2	2	4	0	3	*a* (stony).
22	H. N. Armstrong	3	2	4	0	2	*a* (stony).
	Mayfield-Lismore-Ruapuna District.						
23	R. Oakley, Mayfield ..	3	2	5	1	3	*b*.
24	S. B. McLauchlan, Lismore ..	3	2	5	0	3	*a* (stony).
25	W. J. Imrie, Mayfield ..	2	3	5	0	2	*a* (stony).
26	G. W. Ross (2), Ruapuna ...	2	2	3	0	3	*a* (stony).
27	G. W. Ross (1), Ruapuna ..	3	2	4	0	2	*a* (stony).
28	J. H. Boaler, Ruapuna ..	3	3	5	0	4	*a* (stony).
	Carew-Ealing District.						
29	A. Pithie, Carew	3	3	4	0	3	*a*.
30	J. Cormack, Carew ..	2	2	3	0	2	*a* (stony).
31	J. Ritchie, Carew	2	2	3	0	3	*a* (stony).
32	J. Withell, Ealing	2	2	5	0	3	*a*.
33	B. Withell, Ealing	3	3	5	0	3	*a* (stony).
34	Reith Bros., Ealing ..	2	2	3	0	3	*a*.
	Hinds District.						
35	W. Frampton	2	2	3	0	4	*a* (stony).
36	C. Chisnall	3	2	4	0	3	*a* (stony).
37	T. Wells	3	2	4	0	2	*a* (stony).
38	E. M. Watson	1	1	2	0	3	*a* (stony).
39	J. Bagrey	1	1	3	0	2	*a* (stony).
40	S. Rickards	3	2	4	0	3	*a*.
	Eiffelton-Maronan-Laghmor District.						
41	J. Findlay, Eiffelton ..	3	1	4	0	2	*d* (peaty).
42	H. L. Barker, Maronan ..	2	2	3	0	4	*a* (stony).
43	S. Crossan, Laghmor ..	3	2	4	0	3	*c*.

Table 4—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Seaview-Riverside-Wakanui-Newlands-Seafield-Pendarves-Dromore District.						
44	H. Brown, Seaview.. ..	3	3	5	0	3	*c.*
45	E. Bonnington, Riverside ..	4	2	5	0	3	*a* (stony).
46	A. Bennett, Riverside ..	2	1	3	0	2	*b.*
47	W. J. Doak, Wakanui ..	?	?	?	?	?	*c.*
48	A. Amos, Wakanui ..	1	2	3	0	4	*c.*
49	H. Bonifant, Wakanui ..	1	1	2	0	2	*a* (stony).
50	J. W. Butterick, Wakanui ..	2	2	3	0	3	*a* (stony).
51	W. A. Beggs, Newlands ..	4	2	5	0	4	*a* (stony).
52	A. Gregory, Seafield ..	2	4	5	0	4	*b.*
53	A. Bennison, Seafield ..	3	3	5	0	4	*a* (stony).
54	G. Todd, Seafield	1	1	1	0	2	*a.*
55	A. P. Bruce, Pendarves ..	3	2	5	0	4	*a* (stony).
56	J. W. Watson, Pendarves ..	2	2	3	0	3	*a* (stony).
57	F. Ironside, Pendarves ..	3	3	4	0	3	*b.*
58	P. Doig, Pendarves.. ..	2	2	4	0	4	*b.*
59	H. J. Wilson, Dromore ..	3	2	4	0	2	*a* (stony).

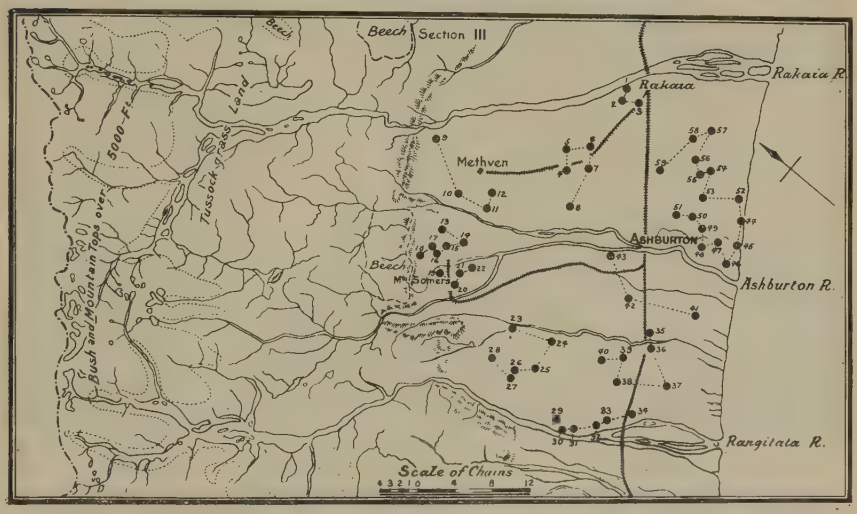

FIG. 7. MAP OF SECTION 3, EXPERIMENTS BETWEEN RAKAIA AND RANGITATA RIVERS.

COMMENTS ON TABLE 4.

Rakaia-Somerton-Hatfield District.—Both lime and super benefited growth, particularly of clovers, with better results in each case where used together. Potash had no effect. Nitrogen stimulated grass-growth where present, but tended to suppress clovers, though not seriously when used with lime plus super. The pastures in Experiments 1 and 2 have become depleted of rye-grass, which is being replaced by hair-grass.

Sherwood-Lauriston-Winchmore District.—The effect of lime and lime plus super was outstanding in Experiments 4 to 7. Marked preference

for the lime-plus-super plots was shown by stock. Potash had no effect on yield or stock-grazing. Nitrogen stimulated grasses, but tended to suppress clover-growth. This suppression of clover was least noticeable where the nitrogen was applied to plots treated with lime plus super. The sward was invariably best on the lime-plus-super-plus-nitrogen plots. Lime is a very important factor in the Sherwood-Lauriston district, and farmers cannot afford to neglect the use of lime on grassland as a foundation for the use of the other manures. (Fig. 8.) Experiment 4 is of particular interest in that clover is now much stronger and thicker on the plot receiving lime plus nitrogen than on the lime alone plot. Lime plus super plus nitrogen is not so good, however, in clover content as lime plus super, although the clover content of the former is quite good.

Mount Hutt - Methven - Upper Winchmore District.—All trials in this group were laid down in July, 1929. The combination of lime plus super gave decided results in three experiments, and it is probable that the effect will be intensified in the present season. Experiment 10 has had to be abandoned on account of grass-grub attack in the pasture.

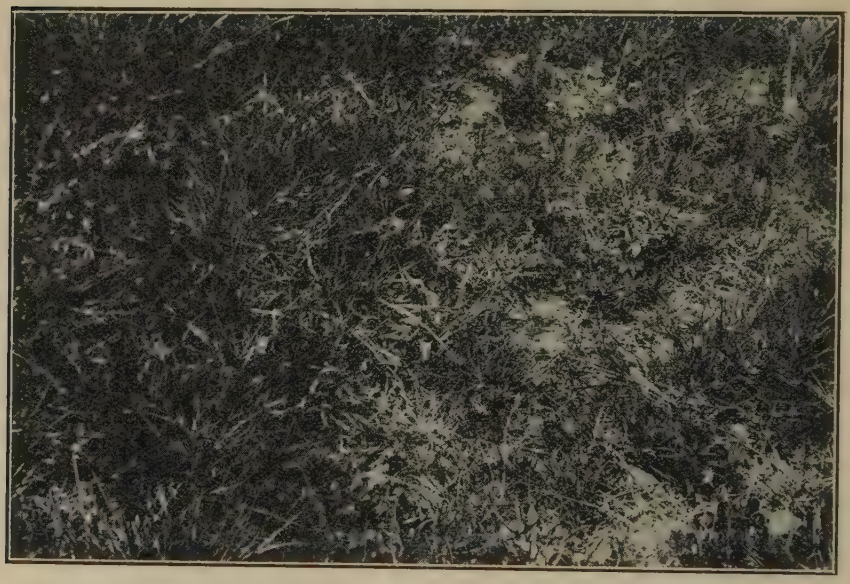

FIG. 8. EXPERIMENT ON FARM OF W. S. LETHAM, SHERWOOD (NO. 7).

On left lime and super, applied in winter of 1928; on right, no manure. Photo taken in November, 1929.

Springburn-Staveley District.—This area receives a heavier rainfall than most of Canterbury, the average fall being between 40 in. and 50 in. Lime plus super was outstanding in effect in five of the six trials. Stock showed a marked preference for these plots. (Figs. 9 and 10.) In Experiment 13 super caused no visible difference, but lime plus super was superior to super. On the heavier type of soil (*d*), nitrogen stimulated grass-growth without appreciably affecting clovers. Potash did not have any apparent effect in any experiment.

Mount Somers District.—With the exception of Experiment 19, the responses to lime plus super were very good, and plots receiving this treatment and nitrogen in addition have been markedly better grazed by stock. The nitrogen response was good where reasonable quantities of the better grasses were present. Potash had no apparent effect.

FIG. 9. EXPERIMENT ON FARM OF W. GUNDRY, STAVELEY (NO. 16).

This is a fifteen-year-old pasture. Left of pegs, lime and super, and lime, super, and nitrogen plots, applied in winter of 1927; right of pegs, no manure. Note closer grazing and stimulation of herbage on treated plots. Photo taken in November, 1928.

FIG. 10. CLOSE-UP VIEW OF PART OF TURF SHOWN IN FIG. 9.

Mayfield-Lismore-Ruapuna District.—The combination of lime plus super was consistently good to excellent, and superior to either lime or super alone. Potash had a slight effect on limed ground in Experiment 23. Nitrogen was consistently fair to good in its effect on grass-growth, without serious reduction of clovers on ground treated with lime plus super. The land in the main is light and the pastures contain much sweet vernal, rye-grass going out rapidly, due no doubt to a large extent to the strain of rye-grass used. The rainfall in this district is about 35 in.

Carew-Ealing District.—Responses to lime and super occurred in all these experiments, the combination of the two being decidedly superior to either alone. The lower rainfall of this district as compared with the previous one detracted somewhat from the degree of response. Potash had no effect. Nitrogen was invariably effective, but as the pastures contain relatively little cocksfoot and rye-grass the effect was on brown-top, fog, and sweet vernal. Generally speaking, clovers were suppressed by the nitrogen, although to a least extent on the lime-plus-super-plus-nitrogen plots, which invariably have the best sward.

Hinds District.—The same remarks apply as in the case of the Carew-Ealing District.

Eiffelton-Maronan-Laghmor District.—Three distinct soil-types are here represented. In all cases lime plus super proved a good combination. The nitrogen response was least on the most fertile soil.

Seaview-Riverside-Wakanui-Newlands-Seafield-Pendarves-Dromore District.—Experiment 47 was abandoned after the first season, as the pasture was badly affected as a result of "getting away." Experiment 54 was abandoned after eight months on account of its being almost pure danthonia, which got badly out of control. The remaining experiments were on soils varying in type. Type of soil did not appear to materially affect the response to treatments, and lime and super gave from good to excellent responses, except in Experiment 49, in which the response was fair only. Potash had no visible effect in any trial. As usual nitrogen was effective in stimulating grass-growth. The degree of suppression of clovers varied on the different experiments, but, generally speaking, the lime plus super plus nitrogen has produced the best sward.

Summary of Experiments between Rakaia and Rangitata Rivers.

Lime.—Of a total of fifty-nine experiments in this area all showed definite responses to lime, except two which are recorded as doubtful. Most of the trials gave fair to good responses, the most outstanding results occurring in the Sherwood-Lauriston district. All districts, except Mount Hutt-Methven (in which the trials have been down for one year only), have a fair proportion of areas where good responses are recorded.

Superphosphate.—All experiments, except two which are in the doubtful class, showed responses to super, the best results having occurred in the districts nearer the Alpine ranges, where rainfall is usually higher. It is extremely doubtful whether the top-dressing of established pasture with super is profitable on some of the lighter and drier soils, such as those in the Seafield and Hinds districts. Reference was made to these soils in the general discussion.

Lime plus Super.—In every experiment except three the combination of lime plus super gave better results than either lime or super alone. As a rule the lime plus super plots were the most palatable to stock.

Potash.—Only one slight and two doubtful responses to potash are recorded.

Nitrogen.—The use of nitrogen resulted in responses in all cases. Usually the nitrogen had only sweet vernal, hair-grass, and brown-top on which to act after the pastures were one to two years old. Suppression of clover was common, but on the lime-plus-super-plus-nitrogen plots the sward as a whole was usually the best of all plots. More persistent strains of perennial rye-grass should assist materially in pasture-production after the first season in the life of the pastures in this district.

D.—Responses to Treatments in Experiments situated between Rangitata and Waitaki Rivers. (Map Section 4.)

Table 5.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type
	Geraldine-Woodbury-Arundel-Orari-Pleasant Valley-Hilton District.						
1	J. Charles, Arundel	3	3	5	1	3	*a* (stony).
2	J. Wooding, Woodbury	4	3	5	2	3	*e.*
3	K. McKenzie, Geraldine	2	4	5	0	2	*c.*
4	R. Volckman, Te Moana	1	1	1	0	2	*f.*
5	R. McLeod, Geraldine	2	2	3	0	3	*b* (stony).
6	J. Gresham, Pleasant Valley	1	2	3	?	2	*f.*
7	F. Charles, Hilton	3	3	5	2	3	*f.*
8	Muff Bros., Orari	2	4	5	?	3	*c.*
	Fairlie District.						
9	Armitage and Jennings, Sherwood Downs	2	2	4	0	4	*f.*
10	A. Campbell, Melville Downs	4	3	5	0	3	*f.*
11	E. Goodwin, Fairlie*	2	4	5	3	Not used	*e* (stony).
12	J. Scarlett, Cattle Valley	3	3	4	0	3	*f.*
	Albury District.						
13	O. Oakley, "The Brothers"	?	0	?	0	3	*f.*
14	R. Irving	?	2	2	0	3	*f.*
15	J. Macauley	2	4	5	0	3	*e.*
	Pleasant Point-Sutherlands District.						
16	W. Talbot, Opuha	3	2	4	0	3	*f.*
17	C. G. Lyons, Hanging Rock	2	2	3	0	2	*e.*
18	R. G. Clelland, Sutherlands	3	3	5	0	3	*f.*
	Cave-Cannington District.						
19	A. E. Gillingham, Cave	1	1	2	0	3	*e.*
20	J. Scott, Cannington	1	0	1	0	2	*d* (stony).
21	D. Priest, Cannington	4	3	5	0	3	*f.*
	Waitohi District.						
22	D. H. Paterson*	4	2+	5	0	Not used	*d.*
23	L. V. Talbot	?	2	2	0	2	*f.*
24	G. A. Davey	2	1+	3	0	3	*e.*
25	J. Lyons	2	1+	2	0	4	*d.*

* Haying Trial—Part IV.

Table 5—continued.

1 Reference No. on Map.	2 Farmer.	3 Lime Response.	4 Super Response.	5 Lime plus Super Response.	6 Potash Response.	7 Nitrogen Response.	8 Soil-type.
	Milford-Clandeboye District.						
26	A. Botting, Temuka ..	?	?	?	0	3	*d.*
27	G. McFarlane, Winchester ..	2	5	5	?	4	*d.*
28	J. Oliver	3	3	4	?	3	*d.*
29	S. McCully Estate, Milford ..	1+	1+	2	0	3	*d.*
30	T. Sheriff, Clandeboye ..	1	1	1	0	3	*d.*
	Seadown-Levels District.						
31	M. J. Fitzgerald, Arowhenua	1	1	2	0	3	*d.*
32	C. L. Orbell, Rosewell ..	4	3	5	0	3	*f.*
33	W. H. Orbell (2), Levels ..	?	?	?	0	3	*e.*
34	W. H. Orbell (1)	2	3	4	0	2	*e.*
	Claremont-Fairview-Salisbury District.						
35	P. R. Talbot, Claremont ..	4	3	5	?	4	*f.*
36	A. P. Kelland, Fairview ..	2	1	3	0	3	*f.*
37	W. J. Black, Salisbury ..	2	2	3	0	2	*f.*
	Pareora District.						
38	A. S. Elworthy	2	2	3	0	3	*f.*
39	A. Stewart Estate	1	?	1	0	3	*f.*
40	G. Sides	1	2	3	0	2	*f.*
	Otaio District.						
41	W. J. Beattie	?	0	?	0	2	*f.*
42	J. Stowell	3	4	5	0	3	*d.*
43	S. Powell	2	3	4	0	3	*f* (ironstone).
44	J. Hall	1	0	1	0	2	*f.*
	Makikihi-Hunter-Hook District.						
45	H. Miles, Makikihi	2	2	3	0	3	*f.*
46	J. Armstrong, Hunter ..	?	?	?	0	2	*e.*
47	W. Miller, Hunter	0	0	0	0	2	*c* (stony).
48	H. Judge, Makikihi ..	1	1	1	0	3	*e.*
49	H. H. Meyer, Hook ..	1	1	2	?	3	*f.*
	Waihao-Forks District.						
50	B. Moyle	2	3	4	?	3	*f.*
51	I. Macdonald	1	1+	2	0	2	*f.*
	Waimate-Glenavy District.						
52	H. Ruddenklau, Waimate ..	2	3	4	0	3	*d.*
53	A. Grant, Waimate	2	1	3	?	3	*d.*
54	R. K. Ireland	4	2	5	0	4	*a* (stony).

COMMENTS ON TABLE 5.

Geraldine-Hilton District.—Effect from lime was apparent on all trials, although on five of the eight the results were slight to fair only. Super effect is recorded on all experiments, and was outstanding on five. Lime plus super proved superior to lime alone or super alone in all except

Experiment 4. The responses to potash were not marked, and were most in evidence where potash application crossed limed ground. Nitrogen effect was most marked in spring growth, and thickened the grass sward considerably on the lime-plus-super-plus-nitrogen plots. Cocksfoot responded to it to a marked extent in Experiment 7.

Fairlie District.—Lime plus super was outstanding in this district. Lime alone and super alone each gave fair to very good responses. The potash response was high in Experiment 11, but not noticeable in other experiments. Nitrogen, as usual, gave good results on the grasses.

Albury District.—Experiment 13 is on pasture consisting mainly of brown-top. Experiments 14 and 15 were laid down in 1929, so that it is rather early to comment on the lime response in Experiment 14, although it is already very distinct in Experiment 15.

FIG. 11. MAP OF SECTION 4, EXPERIMENTS BETWEEN THE RANGITATA AND WAITAKI RIVERS.

Pleasant Point-Sutherlands District.—Lime plus super was outstanding in effect. In Experiment 16 the nitrogen is keeping rye-grass in, whereas brown-top is the dominant grass in the other treatments.

Cave-Cannington District.—The only outstanding response from lime, super, and lime plus super has been in Experiment 21. Experiment 20 was on old brown-top pasture. Responses in Experiment 19 did not show up until the second season.

Waitohi District.—Experiment 22 was outstanding in the response to lime. (A photograph of the plots will appear as Fig. 17, in Part IV.) Otherwise responses were not outstanding, except in the case of nitrogen in Experiment 25.

Milford-Clandeboye District.—Experiments 26 and 30 were laid down in 1929, so that it is rather early to draw conclusions. Experiments 27 and 28 were the most outstanding so far as responses to lime plus super are concerned. Nitrogen was consistently effective in promoting grass-growth.

Seadown-Levels District.—Experiments 31 and 33 were laid down in 1929. Experiment 31 is already showing a fair response to lime, but in Experiment 32 there are indications only. Experiments 32 and 34 showed very high responses to lime-plus-super combinations. Nitrogen effect was best on ground treated with lime plus super.

Claremont-Fairview-Salisbury District.—Lime alone was outstanding in Experiment 35. Lime plus super was superior to lime or super alone in all cases. Indications of a potash response were shown on limed ground in Experiment 35.

Pareora District.—Experiments 39 and 40 were laid down in 1929. The indications to date are that lime is a very important factor. Experiment 38 has been abandoned owing to the pasture running out.

Otaio District.—In Experiment 41 the grass was badly attacked by grass-grub, from which it failed to recover. On two of the experiments super gave good results, more particularly on limed ground. Potash failed to show any effect.

Makikihi-Hunter-Hook District.—Experiments 45, 46, 47, and 48 were laid down in 1929. It is therefore difficult to draw definite conclusions regarding the lime responses, although responses are definite in Experiments 45 and 48. In Experiment 49 the potash response was doubtful. The nitrogen invariably affected the growth of grasses.

Waihao-Forks District.—Lime plus super proved superior to super or lime in both experiments. Potash shows some indication of being effective in Experiment 50.

Waimate-Glenavy District.—The combination of lime plus super again proved effective, particularly in Experiment 54. The effect of potash was indefinite in Experiment 53.

Summary of Experiments between Rangitata and Waitaki Rivers.

Lime.—In fourteen experiments the response to lime alone was good to very good; in thirty-two a slight to fair response is recorded, and in seven others, which have been down about a year at the time of writing this report, there are good indications of a response. Only one experiment is recorded in which lime shows no indication of a response.

Superphosphate.—Response to super alone was good to very good in twenty trials, and slight to fair in twenty-five, in five no response could be detected, while three were indefinite.

Lime plus Superphosphate.—Forty-six of the fifty-four trials showed a decided superiority of lime plus super over super or lime alone. There is no doubt that the use of lime plus super is justified on the majority of good swards of young grass in South Canterbury. The effect of lime and super was almost always accompanied by an increase in clover-growth and a much closer grazing of the sward on these treatments.

Potash.—Only one case is recorded where potash gave good results; in three experiments the responses were slight to fair, and in eight there were indications of benefit. The effect in the latter cases was so slight as to be open to doubt.

Nitrogen.—No case is recorded where nitrogen failed to affect the growth of grass on limed and phosphated plots, especially in the spring, and in some cases the application in the autumn had an effect on the earliness of spring grass. Most of the pastures were too poor to justify the use of nitrogen.

AGRICULTURAL LEGISLATION OF 1930.

A. E. MORRISON, Head Office, Department of Agriculture, Wellington.

LEGISLATION enacted during the New Zealand parliamentary session of 1930 directly coming within the scope of the Department of Agriculture consisted of the Stock Amendment Act, the Slaughtering and Inspection Amendment Act, and the Canterbury Agricultural College Act. The following notes set out the position briefly with respect to each Act:—

STOCK AMENDMENT ACT, 1930.

With the object of compelling the disclosure of all movements of stock by night, and with a view to meeting as far as possible present-day conditions in regard to the transit of stock, this Act extends the scope of the general provision of the present law, whereby a permit is required in respect of the droving of stock by night along any highway, to include the conveyance of stock by night in any conveyance on any highway, or on any lake, river, harbour, or any waters within the territorial limits of New Zealand.

The former exemptions from the general provision that a permit is required in respect of the movement of stock by night are continued under the Act, together with two consequential exemptions to meet cases of stock being conveyed by night by the ordinary rail and steamer services.

SLAUGHTERING AND INSPECTION AMENDMENT ACT, 1930.

This measure adjusts the anomalous position of the law existing prior to its enactment whereby no fees were payable to abattoir authorities in respect of the sale within abattoir districts of carcasses of pigs or of other stock slaughtered and converted into bacon, hams, or tinned meats in specially exempted slaughterhouses whose principal business is the tinning of meat or the curing of bacon and hams, while such fees were payable in respect of the sale of similar meat similarly treated from stock slaughtered in meat-export slaughterhouses. Accordingly the Act provides that fees are no longer payable to abattoir authorities in respect of the sale of such meat in abattoir districts, whether the meat is derived from stock slaughtered in meat-export slaughterhouses or from stock slaughtered in slaughterhouses specially exempted for the purpose.

The Act also makes it clear that no fees are payable to abattoir authorities in respect of the sale within abattoir districts of meat from stock slaughtered in meat-export slaughterhouses and intended for export beyond New Zealand.

CANTERBURY AGRICULTURAL COLLEGE ACT, 1930.

The existing legal sanction for the Canterbury Agricultural College (generally known as Lincoln College), together with that for the Canterbury University College, is contained in the Canterbury College and Canterbury Agricultural College Act, 1896, and in the amendments thereto.

In view of the fact that the Act of 1896 has been amended no less than eight times, and of the further fact that for some time past it has not been convenient that the two institutions should be covered by the same legislation, the law in so far as the Agricultural College is concerned was enacted during the recent session under a separate measure intituled the Canterbury Agricultural College Act, 1930.

Speaking generally, this Act, which comes into force on 1st January next, may be described as a consolidating measure. The opportunity has been taken, however, to bring the law relating to the college into line with certain provisions of the Massey Agricultural College Act, 1926, and of the law relating to the four constituent colleges of the University of New Zealand.

BOYS AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN 1929–30 SEASON.

1. Taranaki and Wellington Areas.

J. M. Smith, Instructor in Agriculture, New Plymouth.

Another successful season's work in connection with the boys and girls' agricultural club movement in the Wellington-Taranaki area must be placed on record. Despite a falling-away in entries in certain section (which can be easily accounted for), the interest in the work is maintained, and the value and importance of the movement thoroughly appreciated by the farming community. The executives in the various districts concerned now have a strong representation of successful farmers on them.

The only new district where the work was introduced during the past year was Ohura, but in the other districts quite a number of new schools came into the scheme. In the area under review there are now some 223 schools competing, with a total of over 1,500 competitors. The main districts and the number of schools competing are as follows: North Taranaki, 48; South Taranaki, 48; Feilding, 44; Wairarapa, 29; Main Trunk Line, 25; Wanganui-Marton, 20; Ohura, 9.

Competitions were conducted on lines similar to those of previous seasons—namely, calf-rearing in both North and South Taranaki and in the Waverley and Ohura districts, and crop-growing in all districts. In the Ohura district a lamb-rearing competition was conducted, with thirteen entries, the winner being Frank Ryan, of Turoto.

Calf-rearing.

The number of calves judged in Taranaki during the past four seasons is as follows:—

	1926.	1927.	1928.	1929.
North Taranaki ..	117	154	215	291
South Taranaki ..	283	344	311	360

This competition is a very popular one, and during the present season calf-rearing is being introduced into several of the districts that have hitherto confined their activities to crop-growing.

Some little misunderstanding still exists as to the method of judging the calves in Taranaki, and no doubt this system will be criticized in new districts, unless an explanation is given. The aim and object is to encourage the competitor to take an interest in live-stock, to develop a love for the animal, and to afford instruction as to the most economical way to rear a good calf. It is recognized that a calf (or any other young animal) if neglected in its infancy will continue to show signs of that neglect throughout the course of its life; and, conversely, that an animal well looked after and handled as a youngster will grow into an animal which will be a source of profit and a pride to its owner. This being so, it will be seen that the actual rearing and handling are probably the two main features of the competition, and the main points awarded are in this connection. Our term "condition" for this is perhaps not the best, as to some it may indicate a beefy animal, which is not altogether desirable when dealing with dairy stock. But the condition actually is dairying condition, and indicates a well-grown healthy calf showing signs of care and attention, and an animal that should make a good milking cow. A competition of secondary consideration so far as the Club movement is concerned is that for "dairy type." The influence of the competitor has very little bearing on type, so that, while recognizing the importance of this feature, type is not unduly stressed so far as the competitor is concerned.

Judging was again carried out by local farmers who are conversant with the ideas of the movement, and they lost no opportunity of giving good sound instruction to the competitors.

New classes were introduced in North Taranaki for pedigree Jersey, Ayrshire, Friesian, and Shorthorn heifer calves. These in no way compete with the grade animals, the competitions being quite separate. The breed societies have been most obliging and helpful in connection with the pedigree classes. The reason for the introduction of these classes was to cater for those children whose parents were pedigree breeders, and to remove the temptation to "ring in" a pedigree calf in the grade classes. The number of pedigree herds in Taranaki also warranted the inclusion of these classes, and the number of entries received justified this move.

A number of competitors of previous years paraded their animals, which are now two-year-olds, &c., before the judges, and it was most encouraging to those connected with the movement to see how this stock compared with the average animal in the various districts.

The championship judging in both North and South Taranaki, when all the group winners are brought to one centre for final judging, forms one of the most valuable occasions in connection with the competition. In addition to the judging, short addresses on various subjects connected with dairying are given by various experts to the competitors, parents, and others, who gather in large numbers. This field-day forms a fitting climax to the season's calf-rearing competition.

Championship winners in each class and competition are given in Table 1 following.

Table 1.

Class.	Competition.	Winner.
	North Taranaki.	
Jersey-Ayrshire ..	Condition	Jack Stockman, Oaonui.
,, ..	Type ..	Connie Stapleton, Egmont Village.
Shorthorn-Friesian ..	Condition	Connie Stapleton, Egmont Village.
,, ..	Type ..	Connie Stapleton, Egmont Village.
Pedigree Jersey ..	Condition	Roy Bell, Oakura.
,, ..	Type ..	Roy Bell, Oakura.
Pedigree Ayrshire ..	Condition	May Weir, Mangorei.
,, ..	Type ..	May Weir, Mangorei.
Pedigree Friesian ..	Condition	Maida Soffe, Tikorangi.
,, ..	Type ..	Maida Soffe, Tikorangi.
	South Taranaki.	
Jersey-Ayrshire ..	Condition	Audrey Morris, Bird Road. Jean McAsey, Te Roi.
,, ..	Type ..	Helen Nicholls, Otakeho.
Shorthorn-Friesian ..	Condition	Gladys Taylor, Fraser Road.
,, ..	Type ..	Brian Morris, Bird Road.
	Ohura.	
Jersey-Ayrshire ..	Condition	Pearl Dougherty, Turoto.
,, ..	Type ..	Pearl Dougherty, Turoto.
Shorthorn-Friesian ..	Condition	Mavis Ryan, Turoto.
,, ..	Type ..	Maurice Kelly, Nihoniho.

Crop-growing.

This form of competition is now showing a decline in entries, chiefly on account of the change in the methods of farming in certain districts. With ensilage gaining yearly in popularity, and having regard to diseases and weeds experienced in cropping, together with the expense of the latter, less area is being sown in crop each year. This means that ground is not available to a large number of competitors who would otherwise compete.

The completed entries and the crops grown in the different districts were as follows :—

North Taranaki : Mangels, 91 ; swedes, 37 ; Senior mangels, 3—total, 131
South Taranaki : Mangels, 55 ; carrots, 52 ; Senior mangels, 4 ; Senior carrots, 7—total, 118.
Wanganui–Marton : Mangels, 74 ; carrots, 47—total, 121.
Main Trunk Railway : Mangels, 73 ; carrots, 24 ; swedes, 3—total, 100.
Feilding : Mangels, 161 ; maize, 18—total, 179.
Wairarapa : Mangels, 76—total, 76.
Ohura : Swedes, 17—total, 17.

This represents a grand total of 742, compared with 847 in 1928–29.

The season proved somewhat unfavourable, for the continual cold and wet weather throughout October and November adversely affected the germination of the crops, and the warm damp weather during the autumn was the cause of much fungus trouble and disease generally.

The number of crops dropping out before completion of the competition continues to be a cause for regret, and although, generally

speaking, a larger proportion of plots were presented for judging than usual, there is yet room for ample improvement. One pleasing feature is that more care is being taken to see that the areas are made stock-proof, and this generally betokens that more interest is being taken by the parents.

In certain districts some experimental work has been introduced with much success. This adds interest as far as the competitors are concerned, and attracts the attention of farmers throughout the district. For the introduction of new varieties, &c., there is no finer method than through the boys and girls' clubs, as by this means they are grown over an extensive area of country and are seen by a large number of farmers. The same thing applies to any experimental work that can be carried out on such small plots; a wide range of soil and climatic conditions are covered, and the multiplicity of plots minimizes any error, while the interest of the parents is commanded.

In North Taranaki two varieties of mangels were grown—Prize-winner Yellow Globe and Jersey Queen. The former variety averaged a yield of 56 tons 9 cwt. per acre, and the latter 46 tons 10 cwt. With swedes a trial was arranged in connection with the control of dry-rot. Half the seed was treated with a 5-per-cent. solution of Semesan, while the balance was untreated. The technique was hardly correct, and this mitigated against the success of the experiment so far as disease-resistance was concerned. The weights, however, were 35 tons 13 cwt. per acre for treated seed and 32 tons for untreated.

This same trial with swedes was carried out in Ohura, where the yields were 34 tons for treated and 33 tons 3 cwt. for untreated. At Nihoniho, where the two plots were kept 4 ft. apart, and where the implements were always used in the treated plot first to prevent the disease being carried to it, the treated plot was not affected with dry rot, while the untreated had at least 60 per cent. of the swedes affected with the disease.

In South Taranaki the same two varieties of mangels were grown (Prizewinner Yellow Globe and Jersey Queen), and these weighed out at 62 tons 19 cwt. and 55 tons 6 cwt. respectively. With carrots, Improved Red Intermediate and Matchless White were grown, the Reds weighing out at 32 tons 17 cwt. and the Whites at 40 tons 11 cwt.

The maize grown in the Manawatu district originated from varieties imported from the United States as characterized by relatively quick maturity. The crops obtained were somewhat disappointing and distinctly variable. Of the varieties grown, Minnesota No. 13 gave definitely the best results, and would seem to be the only one worth while giving attention to under the conditions obtaining last season.

CHAMPIONSHIP RESULTS.

The results for the championship and the average yields were as follows:—

North Taranaki:—

Mangels:	Tons	cwt.
1st, Val Penwarden, Tataraimaka	127	2
2nd, Jim Heppell, Huirangi	108	17
3rd, Doreen Baker, Pukearuhe	90	15
District average	51	0

North Taranaki—continued.

	Tons	cwt.
Swedes :		
1st, Cyril Watson, Huirangi	56	11
2nd, Leon Goppath, Kaimero	62	0
3rd, Alf O'Byrne, Egmont Village	34	13
District average	33	12
South Taranaki :—		
Mangels :		
1st, Les Muggeridge, Auroa	128	17
2nd, George Loving, Huinga	109	8
3rd, Jack Hackett, Okaiawa	100	15
District average	59	3
Carrots :		
1st, George Loving, Huinga	61	14
2nd, Louis Muggeridge, Auroa	61	7½
3rd, Marjory Larcom, Ararata	53	16
District average	35	6
Wanganui–Marton :—		
Mangels :		
1st, Ward Ell, Waverley..	105	2
2nd, Des Fitness, Waitotara	113	9
3rd, A. Middleton, Waverley	123	8
District average	58	4
Carrots :		
1st, Francis Huwyler, Kai Iwi	68	9
2nd, Glaves White, Maxwell	66	4
3rd, Ward Ell, Waverley	50	15
District average	32	9
Main Trunk Line :—		
Mangels :		
1st, P. Weston, Mangaonoho	104	9
2nd, N. Paget, Mangaonoho	94	16
3rd, A. Illston, Silverhope	93	10
District average	51	0
Carrots :		
1st, P. Weston, Mangaonoho	65	17
2nd, L. Rowe, Mangaonoho	64	5
3rd, G. Sands, Orautoha..	45	12
District average	39	0
Swedes :		
1st, D. Bougen, Ngamatea	65	5
2nd, K. Chittock, Ngamatea	58	16
3rd, P. Kennedy, Ngamatea	16	8
District average	46	16
Feilding :—		
Mangels :		
1st, R. Hill, Rongotea	129	4
2nd, A. Christensen, Oroua Downs	113	9
3rd, M. Christensen, Oroua Downs	105	2
District average	50	6
Maize :	Bushels.	
1st, M. Christensen, Oroua Downs	97½	
2nd, A. Christensen, Oroua Downs	82½	
3rd, R. Davis, Glen Oroua	66½	
District average	40	
Wairarapa :—		
Mangels :	Tons	cwt.
1st, Jean McGovern, Mauriceville	99	13
2nd, Walter Allen, Kohinui	85	3
3rd, Alexa Polglase, Ballance	82	5
District average	37	14
Ohura :—		
Swedes :		
1st, Ruth Shields, Rauateti	62	10
2nd, Jack Dougherty, Turoto	50	12
3rd, Doug. Mossman, Waikaka	41	16
District average	34	0

TROPHIES AND SPECIAL PRIZES.

The Henry Lane and Co. Challenge Shield for the school doing the best club work was awarded to the Ararata School, South Taranaki; for the second successive season. The total number of points gained by this school was 64.

In North Taranaki the trophy for the best-kept plot was won by Jim Heppeli, Huirangi. In South Taranaki this trophy was divided between Jester Bootten, Rawhitiroa, and Basil Piper, Finnerty Road.

In the Wanganui district the Thomas Cup, awarded to the school gaining most points in show classes, was won by Westmere School, with a total of 22 points out of 24. The Farmers' Union Shield was won by Upper Tutaenui, with 36·5 points out of 40.

The following competitors in the Feilding District were awarded special prizes for securing the possible points in cultivation: B. Dungey (Aratika), M. Wealleans (Aratika), L. Murray (Ohakea), C. Vautier (Whakaronga).

Senior Clubs.

The season under review is the fourth in which the senior clubs have been in operation in Taranaki. It was hoped that means would be found whereby better touch could be maintained with those junior competitors who, after going through their secondary education, were returning to the land, but the success achieved was not great. During the present season an endeavour is being made to arouse interest in this connection through the Farmers' Unions.

In North Taranaki the crop chosen was mangels, but only four entries were received. The placings were as follows:—

	Tons	cwt.
1st, Dick Oliver, Lepperton	78	8
2nd, Eugene O'Callaghan, Lincoln Road	33	17
3rd, Pat O'Callaghan, Lincoln Road	29	16

The crops grown in South Taranaki in connection with the Senior clubs were carrots and mangels, for which there were seven and four entries respectively. The carrot crops averaged 47 tons and the mangels 63 tons 2 cwt. The detailed results were as follow:—

	Tons	cwt.
Mangels:		
1st, Lloyd Walker, Otakeho	68	13
2nd, Jack Walker, Otakeho	67	12
Carrots:		
1st, Sid. Cleaver, Matapu	60	2
2nd, Allan Wetton, Matapu	60	12
3rd, Harry Feather, Manaia	54	6

(To be continued.)

South American Wools. — Cabled advice received from the International Institute of Agriculture, Rome, states this year's wool-clip in Argentina amounts to 342,000,000 lb., and the Uruguay clip to 154,000,000 lb.

Noxious Weeds Orders.—Kiwitea County has declared the following plants to be noxious weeds under the Act: Barberry, Bathurst burr, broom, burdock, goat's rue, gorse, lantana, St. John's wort, and tutsan. The county has also declared Californian thistle *not* to be a noxious weed within its territory. Waimate County has declared hemlock; Christchurch City, convolvulus; and Lower Hutt Borough, broom, fennel, gorse, and hemlock.

SEASONAL NOTES.

THE FARM.

Pasture Management.

FREQUENTLY towards the end of November or during the early part of December the excessive amount of herbage on the fields under grazing constitute definite evidence that the growth has been more than sufficient to meet the requirements of the stock. When this condition becomes noticeable extensive loss of control of growth is imminent, and unless suitable means of bringing about proper control are adopted poor quality will soon develop in the herbage, and there will be a falling-off in the production of fresh growth in the autumn.

When at this stage the fields under grazing are producing in excess of the requirements of the stock it is often advisable to drop from the grazing programme a field or fields in addition to those which have already been closed for hay or ensilage. Even when an additional field is closed up at such a late stage it may produce a light cutting for hay or ensilage, but even if the growth on it cannot suitably be so used, and hence has to be more or less wasted, this is preferable to the general poor control of the pastures which would have resulted from keeping the field in the grazing programme. The essence of good pasture-management during midsummer is to have some at least of the paddocks producing short, fresh, highly digestible growth—it is much better to have some fields well controlled and some really badly controlled than to have all really badly controlled. The latter condition is the result often obtained by trying to graze an area giving growth in excess of the current requirements of the stock.

At times, and particularly when a farm is somewhat poorly subdivided, it may be impossible to drop a paddock from the grazing programme without reducing too greatly the area being stocked. Under such circumstances topping of the pastures with the mower when portions tend towards rank growth and flower-head production is a measure which gives good results. Topping in this manner is not recommended as a general practice; it is to be considered rather as an emergency measure which may be adopted with advantage when the utilization of pastures has not turned out according to expectations. As a means of dealing with surplus summer growth it is an alternative or second choice to ensilage or haymaking, but it is definitely a second choice. The ideal method is to conserve all surplus summer growth as hay or silage for use during periods of shortage. Often topping is done at a later stage than is desirable; an endeavour should be made to top the pasture early enough to allow of the development of a fresh growth to provide valuable feed from Christmas onwards. Topping has at times been objected to on the grounds that it would leave the pasture so short as to result in undue drying-out during the dry period that often occurs in late summer. This objection is really not to the point, because the mower can be set to give a comparatively high cut and thereby any danger of drying-out avoided, even if dry weather were to set in immediately after the topping—a happening which is quite unlikely unless the operation is carried out unusually late. Circumstances which specially tend to make topping advisable occur firstly when there are few or no dry stock to follow wet stock to remove rough growth left by the latter, and again when harrowing of pastures has been previously neglected. Often during late November or early December it is advantageous to harrow pastures which have been heavily stocked earlier in the season.

Frequently some of the grassland may with advantage be dressed with superphosphate in the early summer. Such a dressing not only will stimulate the production of fresh growth during the latter part of the season, but also will make its influence felt during the following season. If other pastures not top-dressed in the summer are top-dressed in the autumn, the two lots of top-dressing will materially ease the problem of winter feeding. Summer top-dressing as suggested is most effective in parts where a good deal of rain may be expected during December and January, and it declines in effectiveness as the December-January rainfall decreases.

Grassland from which hay or ensilage has been saved usually responds profitably to a December dressing of superphosphate, which favours a vigorous aftermath yielding fresh feed at a period when it is apt to be in scant supply.

Haymaking.

Primarily because of the prevalence of unfavourable weather at the proper haymaking period, much of the hay saved each year is of inferior quality, due either to waiting till favourable weather is experienced and thereby allowing the herbage to become far too mature and woody, or to mowing at the proper stage and being forced to save the hay under unfavourable conditions. In these facts lies part of the strong case for ensilage over wide areas. Late mowing is objectionable not merely because it makes the production of inferior stemmy hay a certainty, but also because it brings about greater weakening and opening-up of the sward, and militates against a really satisfactory aftermath which may prove valuable as a source of succulent highly nutritious feed during the latter part of the summer.

As so many advantages attach to the cutting of the hay crop at the proper stage of growth it behoves one to consider carefully all measures which will enable this to be done and at the same time the herbage to be saved in good condition. Cocking of the hay is one of the measures which should be considered more than it seems to be. Over much of the Dominion it is doubtful if a heavy crop of hay can be well saved without cocking, and with average crops, after making due allowance for the extra labour that cocking at times involves, it could with advantage be adopted on occasions when it is not practised. Cocking is to be looked upon as the ideal method of obtaining the best possible quality hay when the weather is not altogether reliable, and although ideal methods are not always the best from the economic aspect they generally should not be departed from without sufficient reason. Cocking proves particularly valuable in the saving of good-quality lucerne and clover hay.

In the building of the stack a good deal can be done towards securing good quality in the hay. The site should be well drained, and it should not be unduly shaded in a way which will remove the drying influence of winds. For the stack bottom there should be an ample supply of material, such as posts or rails or tree branches, which will favour a dry base of the stack. A high stack should be built so that the roof will be small in proportion to the amount of hay. Although a square stack enables a greater bulk to be stored for a given amount of surface, yet long narrow stacks are often to be preferred, because they admit of more ready drying and cooling of the stacked material. No one working on the stack should stand long on one place, as this causes uneven settling.

If broken weather occurs just after an area has been mown the herbage should within reason not be disturbed until good weather has returned. Any handling that mown material receives makes it much more subject to the detrimental influences of bad weather. If bad weather seems likely the cocking should be hastened, for the amount of washing-out of nutritive matter by rain is much greater when the herbage is in the

swathe than when it is in cocks. In cocks the herbage may cover only one-fifth of the ground it occupies in the swathe; hence it will be subject to the washing-out influence of only one-fifth the amount of water.

The best time to cut lucerne cannot always safely be determined by the flowering development. A safer guide is the development of basal shoots. When fresh shoots coming from the base or crowns of the plants are about an inch long the lucerne should be mown.

General Cropping Work.

After allowing fully for what can be done in the sphere of good grassland-management one is forced to the conclusion that the growing of special crops for stock-feeding could often with advantage be made to occupy a much more prominent place than it is now given.

The great importance of the special crops used in our system of animal husbandry arises primarily from the fact that most of these crops serve the function not of coarse fodders or roughages, but of concentrates. Concentrates essentially are low in fibre and highly digestible. The need for them arises specially when the remainder of the ration of which they form a part consists of woody fibre of poor digestibility, and the need for plenty of concentrates becomes specially pressing in the nutrition of animals of high production. Crops such as green lucerne and green cereals before they are in bloom, turnips, and rape are essentially concentrates. They are diluted concentrates it is true, but nevertheless concentrates by virtue of their composition and of the functions they can fulfil. To a considerable extent they take the place in our farming that concentrates out of a sack take in European and American farming in supplementing the coarse fodders or roughages.

All this may seem a somewhat irrelevant digression if it is not kept in mind that the relatively expensive grains and meals freely used in other countries may be replaced in New Zealand to a great extent by the comparatively inexpensive farm-grown "diluted concentrates" provided by such crops as soft turnips, rape, &c. In reality our markedly economical butterfat and fat-lamb production hinges on our cheap concentrate-feed production through the agency of young grass and suitable forage and root crops. This will indicate the importance of factors which limit the yields of such crops. Inadequate cultivation is such a factor. Farmers' crop competitions have been of considerable instructional value in demonstrating in a concrete manner that money spent on good land, good manure, and good seed is at least partially wasted if not linked with good cultivation. The cultivation which precedes seed-sowing is of basic importance; if it is deficient nothing can be done later to remedy the position fully.

Thorough preparatory cultivation, however, while valuable, is far from sufficient. Intertillage, when practicable, should be carried out as soon as possible after seed-sowing with such crops as mangels, potatoes, and carrots. All these and similar crops thrive on ample working of the soil round the plants, because such working not only kills weeds but also conserves the supply of soil-moisture and otherwise increases the soil fertility.

Apart from intertillage, root crops which were sown on ridges during October or November usually require thinning in December. In thinning mangels the soil should be drawn away from the seedlings rather than hoed up to them. The space between mangels may range from 9 in. to 15 in. according to the conditions; on the average it should be about 12 in., but Yellow Globes on really good soil may be spaced 15 in. apart.

If at thinning-time mangels are pale and seem to be faring poorly, they will often respond profitably to a top-dressing of nitrate of soda or

sulphate of ammonia sprinkled along the rows, at the rate of 1 cwt. an acre, in such a manner that the fertilizer is not deposited on the seedlings. These manures should if possible be applied during moist weather.

Based upon experience it has become the practice over wide areas to sow swedes in December at the rate of 10 oz. to 14 oz. per acre through every second coulter of an ordinary grain-drill. Information regarding turnip manuring in Canterbury is given in a separate article in this issue of the *Journal*. If it does not suit to use lime in the manner suggested in the article, a mixture of super and one of the slower-acting phosphates in equal proportions may be used. The slower-acting phosphates include basic slag and the Island and African phosphates. In many parts with a reasonable rainfall a mixture of superphosphate and bone-dust gives excellent results with swedes. A fine firm seed-bed favours a good strike with swedes.

Maize and millet to provide green fodder may often be sown successfully in December.

Much valuable weed-control work can be done in midsummer, either by destroying seedlings or by attacking perennial weeds when they are in the early flowering stage well before seeds have advanced towards maturity.

Spraying for Control of Potato-blight and Similar Diseases.

As a rule satisfactory results are obtained only when spraying is treated as a preventive rather than as a cure. Spraying is of distinct value in checking the spread of blight which has gained a footing in a potato crop, but its greatest value lies in preventing the footing being gained. This means that spraying should be commenced early, before the disease has become established. The following note by Dr. G. H. Cunningham, Mycologist to the Plant Research Station, is of seasonable value, especially because it contains a description of a modified improved method of preparing bordeaux mixture for potato-spraying. Dr. Cunningham says :—

"Of the sprays available, burgundy and bordeaux mixtures are generally used, lime-sulphur or sulphur alone having proved of little use.

"Burgundy mixture: This spray, made by mixing bluestone (copper sulphate) and washing soda (sodium carbonate), has long been a favourite owing to its ease of preparation. The formula recommended is 4–5–40 (4 lb. bluestone, 5 lb. soda, and 40 gallons water). To prepare, nearly fill a 40-gallon cask with water, and to this add the bluestone (dissolved in a small quantity of hot water); dissolve the soda in a small quantity of water, and add to the cask, stirring vigorously the while. Bring the quantity of water up to 40 gallons, and apply as rapidly as possible.

"Bordeaux mixture: This consists of a mixture of freshly slaked quicklime and bluestone. It has largely become replaced by burgundy owing to the difficulty of securing a proper mix and of procuring and storing the quicklime. This is to be regretted as it is a more efficaceous spray, and for this reason the following modified method of preparation is recommended, together with a formula of 3–5–40. Dissolve the bluestone and add to the water in the cask; then weigh out the required quantity of *hydrated* lime, cream it by mixing the powder with a small quantity of water until it assumes a cream-like consistency, and pour into the solution of bluestone in the cask. Prepared in this manner this solution is just as easy to make as burgundy, and considerably more effective.

"To prepare hydrated lime weigh out a given quantity of good-quality quicklime, and add to it one-third of its weight of water. Thus 30 lb. of quicklime will require 10 lb. (1 gallon) of water. The result will be an impalpable fine white powder mixed with impurities present, such as sand, fragments of rock, &c. Sieve through a fine mesh, screen, and store in air-tight containers, where it may be kept indefinitely until required. This quantity of water ensures that slaking will be complete and that the

resultant will be in powdered form. Hydrated lime changes slowly back to the carbonate on exposure to the air. The change is slow, however, so that little conversion occurs until some weeks after its preparation, and for this reason small quantities can be held in open benzine tins during the spraying season.

"The advantages of this bordeaux spray over burgundy are: (1) The spray is more insoluble, and therefore lasts much longer on the plants; (2) being more insoluble it is less likely to damage foliage; (3) it is a better fungicide; (4) it can be mixed with arsenate of lead (as a controllant of chewing insects), whereas burgundy cannot."

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Spray Controls.

THE treatment of the orchard during the coming month must be regarded as of vital importance. Humidities and temperatures are conducive to fungus development, while the initial and in most cases the main broods of insects will be increasing unless vigorous and well-timed attention is given to controls. Close and careful observation of detail in both fruit and foliage is well-spent time, and it can be recommended to all growers to spend a few hours each week in carefully checking developments of fungus diseases and insect pests on the different varieties. The result of such observation will often adjust and correct for the better an otherwise more-or-less fixed spray programme.

From now on precipitated sulphurs are recommended as supplementary to the weak dilutions of lime-sulphur and arsenate of lead combination. Although in some instances precipitated sulphur alone may be used to advantage on such tender varieties as Cox's Orange and Dunn's Favourite, the greater value lies in the practice of adding 3 lb. to 5 lb. to lime-sulphur. By so doing the sulphur content of an otherwise dilute solution is raised to a more efficient standard without materially increasing the caustic properties of the spray. Cases have recently come under the notice of the writer where growers were adding as much as 5 lb. of precipitated sulphur to a spray of 1–25 strength. This appears to be extravagant and needless, the sulphur content of the solution being sufficiently high to give full efficiency.

Thinning, Relief of Leaders, &c.

Towards the end of November thinning can be commenced on early varieties, having in mind that the operation should be regarded as part of a progressive practice. The natural drop of all varieties will hardly have finished by the end of the month, while a progressive thinning will give a longer period in which to discard diseased or otherwise worthless fruit.

The picking-off of fruit which has developed from fruit-buds situated on the terminals of leading branches should now be completed immediately, so that maximum growth may be obtained in this section of the tree. Weak fruiting laterals which have obviously set more fruit than is desirable should also be relieved at the initial thinning.

Red Mite Pest.

Those districts which have experienced a dry October may expect bad infestation from red mite. Where such is the case an application of red-oil emulsion at 1–200, plus Black Leaf 40, or the addition of Black Leaf 40 to the routine applications of lime-sulphur, will do good work in preventing serious infestation at the latter part of the season. At this time of the year red mite is often confined to certain varieties or locations in the orchard, and in such cases prompt measures will prevent the pest becoming

general throughout the orchard. There is little doubt that many growers regard red mite too lightly, largely due to the fact that this insect does not render fruit unmarketable. They lose sight of the debilitating and weakening effect of the pest on the trees, which is subsequently reflected in a light crop the succeeding year, diminished wood-growth, and a loss of resistance to chemical spray compounds.

Cultivation.

From the month of November onward a top mulch of pulverized soil should be maintained in order to conserve reserves of moisture, to ensure as uniform a growth as possible, and to enable the proper functioning of artificial fertilizers which may have been applied.

—M. Davey, Orchard Instructor, Mapua.

Citrus Culture.

As the spring growth on citrus trees which escaped the winter frosts should now be well started, all undesirable shoots can be rubbed out, thus saving time later on.

As mentioned in last month's notes, a careful watch should be kept for fungus disease. When the main crop of blossom has set lemons should be sprayed with bordeaux 4–4–40 for verrucosis, and owing to the prolonged flowering period it will be necessary to make two or three applications to ensure a clean crop of young fruit. Owing to the weather conditions experienced this spring the liability to brown-rot has increased, and care should be taken to see that all lower branches are at least 18 in. clear of the soil. A light dressing of sulphate of iron beneath the trees to destroy the fungus spores in the soil, together with the application of bordeaux as previously specified, should help considerably in keeping away this trouble.

Should scale be in evidence, spraying with a summer oil 1–40 is advisable, and where thrips are present the addition of Black Leaf 40 at 1–800 can be made; or, if preferred, the Black Leaf can be combined with the applications of bordeaux. A good look-out for borer should be continued, and treatment given as advised in the previous notes.

As soon as the weather is settled every effort should be made to cultivate the surface soil to a good tilth while it is in an easy workable condition. Not more than 6 in. in depth is desirable, owing to the liability of injuring the feeding roots.

Trees which have suffered from the frosts should have all the frosted wood cut back to clean wood, so as to give the new growth every advantage.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Artificial Stimulants to Egg-production.

A SURPRISING number of poultry-keepers have sought my advice of late as to the value of certain chemicals, tonics, condiments, &c., for stimulating egg-production, with the idea of counteracting the present increased cost of production caused by the high prices of foodstuffs. Usually such inquiries come from those who have had little experience in the business, and who fail to realize that a maximum egg-yield can be secured from a simple ration in which condiments and questionable stimulants are not included.

It should be remembered that the power to produce eggs in large numbers is an hereditary character. To enable a bird to yield to her maximum capacity all that is required is to maintain her in a healthy condition and to supply her with the necessary food for the making of her

product. It has been said that for the maintenance of good health the heavy layer should be periodically provided with a tonic, but in this connection it is well to remember that the food and treatment which will enable a bird to produce to the best advantage will also be for the benefit of its health and consequent freedom from disease.

The best advice I can give those who are looking to theoretical short-cuts for advancing egg-production, and at the same time looking to questionable stimulants as a means of reducing the cost of production, is to keep only those fowls that will show a profit—by culling and better feeding. Food is certainly high in price, but nothing will be gained by stinting the layer. It is always a sounder policy to feed half a flock thoroughly than put the whole flock on half rations. As to the use of condiments and questionable stimulants for consistently increasing egg-production, this is answered by the fact that the high records put up at laying competitions, both with fowls and ducks, are established without the aid of these materials.

Efficient Feeding.

No definite amount of food can be specified for daily supply to any given number of laying fowls. The only safe course is to feed them according to their appetite. The rule of weight or measure cannot be fixed, because the birds do not eat the same amount of food each day or at each meal. Their appetites vary according to the season of the year and whether they are in a laying condition. Obviously as egg-production increases the bird will demand a greater food-supply, because it is impossible to get something from nothing. There are many different rations that will produce good egg-yields. The great essential is to see that the food is of good quality, palatable to the birds, and fed in sufficient quantities. Not only should sound and palatable grain material be provided, but in addition some form of animal food should be included in the ration. Instinct in the laying bird demands an adequate supply of animal food, and if deprived of this she will not produce to her maximum capacity. When boiled meat is not obtainable a reliable brand of meat-meal makes a good substitute. This material may be supplied in the morning mash at the rate of, say, 8 per cent. of the aggregate weight of the mixture when dry. In addition the meal may be fed in a separate receptacle and left for the birds to pick at whenever they choose.

When skim-milk is available this may take the place of meat and meat substitutes, as there is nothing better for promoting egg-production. Indeed, it is good for stock of all ages, except perhaps in the case of the growing pullet, when, as with any forcing diet, too much milk is apt to promote egg-laying at too early an age before the bird attains proper body development. This usually results in a weedy specimen of the breed and a producer of small eggs. Where it is found that a pullet is showing evidence of prematurity the milk should be used sparingly or, better still, eliminated from the ration. Particularly should the birds not be compelled in hot weather to drink a large quantity of milk merely for the purpose of quenching their thirst, or ovarian troubles and the production of weak-shelled and shell-less eggs are apt to result. Where milk is provided in large quantities the risk of these troubles making their appearance will be minimized if water is provided in a separate receptacle. A good method of using skim-milk is to let it sour and coagulate, which may be hastened by the inclusion of a small quantity of pollard. After the whey has been poured off it is a good plan to place the curd in a lightly woven sack and allow it to drain well before feeding to the birds.

Economy in Production.

While recommending sound and liberal feeding, it is fully realized that the profit from poultry-keeping is not so much determined by the gross

return as by the difference between cost of production and the market value of the produce. Probably the chief means whereby the average poultry-keeper could reduce his food-costs, and thereby make a greater profit from his fowls, is to use a larger proportion of feeding materials which can be grown on his own land. This mainly applies to green stuff, as it will seldom pay the average poultry-keeper to grow grain on a scale to suit his requirements. But though it is possible to reduce the cost of feeding on many plants by growing and feeding a greater quantity of green material, even in this direction there is a point beyond which cheapness in feeding may easily become false economy. For example, when the morning mash chiefly consists of boiled laxative green material, such as cabbage, silver-beet, turnips, &c., dried off with a very little pollard (which is often more like bran than the genuine article), it is only to be expected that for the lack of a due proportion of solid matter the birds' egg-laying must be reduced—and no stimulant will help it. The value of green food for birds of all ages is great, but in the case of the layers it is always a wise course to provide it in such a way that they can take just what they want without being compelled to eat more than nature demands. Hence when high egg-yields are looked for green-stuff should be sparingly used as a means of bulking the morning mash, but fed with a free hand by itself.

Where suitable soil is available the growing of a patch of lucerne is recommended. The feeding value of this highly nitrogenous plant, as compared with others commonly used for feeding purposes, is not generally realized by poultry-keepers as it should be. Lucerne serves a dual purpose, as it can be fed as a green food during the greater part of the year, while any surplus can be easily made into hay for winter use. Finely chaffed well-cured lucerne hay, boiled overnight and mixed in the morning mash (in which it can be included to a greater extent than other more laxative foods) not only has the effect of making the mash more appetizing to the birds, but, being rich in protein, also tends to promote egg-production. Hence it replaces to a great extent the more costly grain-foods, thereby effecting a desirable economy. Red clover is another fodder plant that may be grown by the poultry-keeper and fed with advantage in a similar manner to lucerne.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Requeening.

THE most important bee within the hive is the queen, and it is useless to expect a colony to be productive unless she is a good one. It is therefore highly essential that all colonies should be headed with prolific queens of a good strain if vigorous workers are to be raised. Queen-rearing is an important adjunct in apiary-management, and unless provision is made to requeen systematically the beekeeper will find dwindling colonies and diminished crops. Where practicable, it is advisable to requeen the colonies every year. Exception, however, must be made in the case of hives containing breeding-queens, and others retained on account of desirable drones.

Where the operations of the beekeeper are such as to prevent annual requeening, provision should be made to replace half the queens in the apiary each year. If this plan is followed no colony will have queens more than two years old. With the aid of a few nuclei young queens can easily be hatched and mated, but in many cases—especially where a swarm has emerged from a hive—virgin queens can be secured and form an easy solution of the requeening problem.

No better plan can be followed by the beginner than to utilize queen-cells produced naturally—that is, under the swarming impulse. It has been proved that in New Zealand the best months for raising queens are from November to January. During this period everything is favourable to the operation, as the hives are at their highest state of prosperity. Under normal conditions the workers and drones are at their best, this being the swarming period. There is practically no risk of robbing; the young queens are readily accepted, and will tend to reduce swarming. Moreover, a queen introduced during the months of prosperity will produce numbers of young bees for the winter, and still be fairly young in the following spring. In the case of after-swarms, these may be sifted through an excluder placed between two empty supers, when the queen or queens can be removed. The bees will then return to the parent hive.

These young queens can be utilized for starting nuclei. It always seems a pity to destroy the young vigorous queens bred under the swarming-influence, and wherever there is an opportunity they should be saved and failing queens destroyed. A handy method of introducing virgin queens is by the smoke method. The old queen must first be removed from the hive that is to be requeened. The entrance then is contracted, and a few vigorous puffs of smoke are forced in through it. Then, before the bees have recovered from this treatment, the virgin queen is released at the entrance, piloted into the now queenless hive, and hastened therein by several more puffs of thick smoke. The hive is then closed altogether for about ten minutes, after which the entrance is once more opened slightly and left like this till the next day, when the full entrance can once more be allowed.

Extracting Preparations and Practice.

Preparations for extracting the honey must now be well in hand. By the time these notes are published the main flow should have started in the North, but it will depend entirely upon weather conditions. In the South the flow is fully three weeks later, and extracting rarely commences before the New Year.

It is well to get all the arrangements for handling the crop completed before the honey is sealed and ready for the extractor. It does not take a great deal of time to prepare extra supers and frames, but these are of inestimable value to the beekeeper when the main flow commences. Every year immense quantities of honey are lost through lack of proper gear for handling the crop, or through the unreadiness of the beekeeper when the hives are full of honey. It is poor economy to keep one's supply so low that the bees hang about outside the hive and loaf for want of combs in which to store the honey.

Room should be provided for the workers as soon as the first honey is capped, either by extracting the combs or by supplying them with another super. Keeping the extractor running from the beginning of the honey-flow till the end is good beekeeping, provided the honey is not extracted while in an unripe condition. Although some authorities advocate leaving all the honey until the end of the season—thereby building colonies three and four stories high—the result is rather heavy work, and this method is anyhow not advisable in Southern localities. Where the summer is short and variable the risk of getting the honey chilled by leaving it in the hives until the end of the season is too great. Honey, except in a few instances, is best extracted when warm from the hives. In fact, where there is any tendency to "thick" honey, extracting while the honey is warm is the only way to obviate breaking the combs in the extractor.

Comb-honey should be treated in the same way. All sections should be removed from the hives as soon as they are filled. This makes them less liable to be daubed with the propolis and to become "travel-stained" by the constant passage of the bees.

The extractor, tank, and all the rest of the gear connected with the handling of honey should be scalded and thoroughly dried before commencing the season's work. Honey, by reason of its peculiar method of production, does not call for the daily cleansing required by other foods, but it behoves the beekeeper to see that his honey-house is as trim as hands can make it. After the extractor has been scalded it should be kept covered with a clean washing cover when not in actual use, and every receptacle containing honey should receive the same treatment. These covers are easily made and washed, are inexpensive, and add much to the condition of honey as an article of food. No bees, flies, or any extraneous matter should be allowed to touch the honey once it leaves the extractor, and from the time the bees gather it till it leaves the beekeeper's hands for market his aim should be to produce a dainty and attractive article of food.

Extracting-appliances.

It is useless trying to work bees profitably without proper appliances. These consist of an extractor, uncapping-knives, uncapping-can, and settling-tanks. Many beekeepers make the mistake of trying to get along with any makeshifts, but experience will teach that it is a poor policy to endeavour to operate without an up-to-date equipment. However small the number of hives kept, if extracting is the objective it will be found to be most profitable to install a four-frame machine. Costing a little more at the initial outlay, it will soon pay for itself in labour-saving, and enable the beekeeper to meet the biggest flow. In any case he should not be persuaded to purchase a machine that will not reverse. Fixed machines are labour-makers, besides being messy in working. When fifty or more colonies are worked it will be found that a power plant pays for itself over and over again.

Second in importance is a good tank. No apiary equipment is complete without one or two good tanks. Too little attention is paid to maturing the honey when out of the hive, and freeing it from the minute particles of wax which float on its surface. It must be left to the beekeeper to decide the size of tank he requires, this depending on his needs and conveniences.

For rapid working two ordinary uncapping-knives are very convenient, but as yet no better invention has been given to the beekeeping world than the steam-heated knife. This knife obviates the necessity of constantly dipping the cold knives into hot water, and the work of uncapping can proceed uninterruptedly. There are several uncapping-cans and melters on the market, most of which are more or less satisfactory, but the perfect capping-melter has yet to be invented.

Treatment of Disease.

If the weather conditions have not been favourable for the treatment of foul-brood, this should be undertaken when the first opportunity occurs. Do not delay until the main flow arrives. Remember that if colonies are treated early enough a surplus of honey will be secured and the expense of treatment recovered. Handling clean bees is a constant source of delight, but diseased bees are a never-ending cause of trouble. Full particulars of the treatment of foul-brood are given in Bulletin No. 119, "American Foul-brood and its Treatment," which can be obtained free from the Department of Agriculture, Wellington, or from the Apiary Instructors in each centre.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

Tomatoes under Glass.

The production of tomatoes under glass has now grown into a big industry, and in Southern districts many of the houses are heated. When artificial climatic conditions are created for growing the crop it is necessary to see they are properly maintained. The need is still greater when heat is used and the object in view is to ripen the crop at a still earlier period. The houses then require a great deal of attention. In this phase of tomato-culture there is often room for great improvement. To go to the expense of this equipment and then find one has not time to attend to it is serious mismanagement, but the excuse is bad, as it would pay to obtain further assistance if the management was right. During late winter and early spring the weather and temperatures are notoriously variable, and frequent adjustments are needed to maintain the right temperature and humidity in a crop under glass. Obviously this is best done by one who takes or is given the direct responsibility of attending to the houses, and who is constantly at hand to do so. In this way only can the right conditions be maintained, and the crop then develops in a satisfactory manner within the expected period. The successful crop is one which has been grown under good conditions right from the sowing of the seed; every vicissitude takes its toll by diminishing or deferring the harvest.

The installation of the "Iron Fireman," which automatically stokes the furnaces, in the larger greenhouse plants indicates the enterprise of growers and extent to which the industry has developed. The machine has given great satisfaction; it can be finely adjusted, and temperatures are controlled automatically by the operations of a thermostat. In one or two instances, however, the necessity for ventilation, which still remains, has been overlooked. The tomato-plant by nature requires a comparatively dry, buoyant atmosphere, and it is only by means of ventilation that this can be obtained. A close, humid atmosphere produces soft thin leaves, and the flowers fall without setting. The plants also are very subject to disease under such adverse conditions.

The earliest crops are grown in pots in a heated house. This method has been demonstrated to induce earlier maturity than when the plants are set out in the ground. The advantage is offset by the extra attention required in the way of watering and feeding, but under some circumstances it is satisfactory. In this method of production trouble is sometimes met with by cold water being used for watering the plants. Such treatment causes a serious check in the growth and development, and is really inexcusable. The boiler-capacity is generally sufficient to provide the quantity of tepid water required, and which should always be used in heated houses.

Small Fruits.

The harvest season for small fruits has now arrived, and growers are busy packing and consigning the fruit. The prices and demand are generally good, but the perishable nature of the berries makes the work difficult, especially when production is large in restricted areas. The distributing campaign then requires to be well worked out, and the rules for picking and packing carefully observed. Some organization is required to give this a full measure of success, but it would be a fine achievement and a great benefit to many sections of the community.

Berries growing on land that is naturally overdrained frequently suffer at this season if the weather is dry, especially strawberries and raspberries. Under such circumstances irrigation would be of great benefit in developing the crop. In strawberry-beds the runners should be destroyed, unless they are required for planting later, in which case the plants should not be

allowed to bear fruit. Suckers and basal growth about gooseberries and red and white currants should be removed; also crowded water-shoots about the centres of gooseberry plants.

Market Garden Crops.

During the months of December and January the following crops, which mature during the winter and early spring, should be planted: Savoy cabbage, brussels sprouts, broccoli, cauliflower, celery, and leeks. Make sure that the plants are free from disease before shifting them. Water them the day before lifting, and then ease them with a fork so that the roots are injured as little as possible. Plant rather deeply and firmly in dull weather. Keep a watch for pests or disease, and give them a puff of dust or spray as may be necessary. The celery is almost sure to require a burgundy-mixture spray occasionally to protect the plants from fungus blights.

As the early crops are lifted sow shorthorn carrots, turnip-rooted beet, spinach, peas, dwarf beans, swedes, and lettuce. The latter is best sown thinly at this season, with a view to it maturing without transplanting.

The Homestead Garden.

There appear to be two methods of pruning established hydrangeas generally practised in this country. The one is to cut all the young growth back very hard and the other to thin it out severely, removing especially the weak and old wood. The latter is much to be preferred; the plants flower better and earlier. Under the former method the growth is very dense, and flowers are meagre and late in appearing.

These notes are written during "lilac time," and the generous display of lavender, white, and purple spikes of blossom is very attractive. It is to be noted the blooms are best where the bushes are well thinned out and all suckers suppressed. The thinning is best done after flowering. The flowers appear on wood when it is one year old.

In sheltered gardens with good treatment cydonia japonicas (*Pyrus japonica*) have been a mass of glowing colour of many kinds. Sometimes the display has been discounted and obscured by leafy growth caused by pruning back young growth to wood buds. In building up the bushes this may be necessary, but afterwards it makes them unnecessarily dense and is detrimental. These vigorous plants flower on the old wood, and successful pruning lies in thinning out the growth altogether rather than shortening it.

The season for garden-making commences with the month of February. To be successful the plans must be well thought out, and preferably plotted out on paper. To do it well the work must not be done hastily, but carefully considered and well proportioned, paying special attention to grades and levels. This is the secret of success. Whether work of this kind is to be done on a scale that is large or small the planning should be commenced now, making a feature of the selection and arrangement of the trees and shrubs.

Those interested in herbaceous plants will appreciate some notes taken from a contemporary overseas journal dealing with the new hybrid meconopsis (*Meconopsis Baileyi*), which is so much admired for its large pale blue flowers. The chief complaint regarding *M. Baileyi* appears to be its poor seed-germinating powers. Undoubtedly this is so if the seeds are sown in spring; they should be sown as soon as ripe—say, February or March—as the vitality deteriorates rapidly. They may be sown in boxes placed in a cold frame, or the seeds may be sown and raked-in in cool shady woodland border. During the winter they may appear as if they had damped off, although they have only gone to rest, and will readily commence to grow in the spring. The plant is quite hardy.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: OCTOBER, 1930.

Dominion Meteorological Office.

THE past month was, for the country as a whole, the coldest October experienced in New Zealand since the accurate recording of temperatures commenced. From all parts of the country came accounts of the coldness and backwardness of the season. October is the month in which pastures usually show rapid growth after the semi-dormant winter period, but this year the growth was reported as very poor in most districts. The stormy weather experienced during the month added to its severity. The adverse conditions as regards growth of vegetation were accentuated also, so far as most eastern districts are concerned, by lack of sufficient precipitation. In consequence, stock were generally in a somewhat backward condition. Frosts occurred on several days over large parts of the Dominion, and in some cases they were severe. A certain amount of damage was consequently caused to orchards and small crops, but, generally speaking, it does not appear to have been severe.

Rainfall.—Precipitation was greater than the average on the west coast of the South Island, over most of Otago, and in scattered parts of the western districts of the North Island, especially around Auckland. Elsewhere there was a deficiency. Even in Central Otago some parts had less than the average amount. In North Auckland, and the East Cape, Gisborne, Hawke's Bay, and Wairarapa districts, around Wellington, and in Nelson, Marlborough, and North Canterbury the month was a very dry one.

Snow fell on the ranges on the 14th, 17th to 19th, 22nd, 23rd, and 25th. The falls which occurred at various places on the 17th, 18th, and 19th were the heaviest, and extended to low levels in parts of the South Island. Hailstorms were frequent at many places.

Temperature.—As has been mentioned, temperatures were generally lower than had been recorded for the month hitherto in New Zealand. At Napier, Hokitika, and Dunedin one slightly colder October has been experienced, but at all other stations this year's was the coldest. It is noteworthy that the present spell of subnormal temperatures has lasted, with only short breaks, over most of the country since June, 1929.

Storms and Pressure Systems.—At the beginning of the month a deep depression was located to the east of the Dominion, and strong southerly winds and very cold temperatures prevailed during the first three days. A series of depressions of the westerly type followed. These caused squally and showery weather in western districts, more especially of the South Island, where the rain was heavy. Hailstorms were rather frequent.

On the 13th a deep cyclonic depression developed at the eastern entrance to Bass Strait, and, moving eastwards, crossed North Auckland on the 15th. A secondary followed it on the 16th. Heavy rains fell on the 14th or 15th over most of the North Island.

This depression passed eastwards, but on the 17th commenced to deepen in the neighbourhood of the Chatham Islands. From the 17th to the 19th strong southerly winds and cold weather prevailed in consequence. The southerlies reached strong gale force in places, and on the 19th some damage was done at Christchurch. There was much snow on the higher levels, and thunder and hail in places.

Another spell of westerly weather followed, but pressure remaining low to the east, winds were more frequently from south of west than north of it. On the 22nd and 23rd very boisterous conditions prevailed. Damage was done by westerly gales in the Taranaki Bight on the 22nd. Further snowfalls occurred on the high levels.

A depression which crossed the Dominion on the 24th developed a cyclone in its northern portion, and on the 25th this was centred east of Hawke's Bay. The west to south winds in its rear were again particularly severe. Rain was widespread, many heavy falls being experienced. The 25th was the worst day, and considerable damage was done at Auckland. Snow fell on the ranges. On the 26th there were severe thunderstorms from Auckland northwards, and at Kaitaia a small tornado developed from one of these.

A vigorous westerly depression crossed the South Island on the 30th and 31st, causing heavy rain in western districts.

RAINFALL FOR OCTOBER, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
	North Island.				
		Inches.		Inches.	Inches.
1	Kaitaia	2·13	18	0·64	5·98
2	Russell	1·83	8	0·96	4·44
3	Whangarei	2·00	20	0·41	5·04
4	Auckland	6·11	20	1·23	3·71
5	Hamilton	4·56	16	1·00	4·77
5A	Rotorua	2·95	13	0·85	5·40
6	Kawhia	5·84	18	1·28	5·24
7	New Plymouth	5·27	22	0·89	5·62
8	Riversdale, Inglewood ..	7·81	20	1·36	10·54
9	Whangamomona	6·63	16	1·23	8·64
10	Eltham	3·98	15	0·70	5·00
11	Tairua	7·18	13	2·60	5·99
12	Tauranga	4·17	11	1·16	5·44
13	Maraehako Station, Opotiki	4·92	17	1·88	5·51
14	Gisborne	1·22	9	0·43	2·77
15	Taupo	2·93	14	0·63	4·46
16	Napier	1·37	14	0·76	2·28
17	Hastings	0·73	14	0·23	2·32
18	Taihape	4·28	21	0·37	3·86
19	Masterton	2·91	20	0·48	3·36
20	Patea	3·48	15	0·70	4·29
21	Wanganui	4·38	14	0·87	3·48
22	Foxton	2·39	15	0·47	3·11
23	Wellington (Karori Reservoir)	1·52	13	0·23	3·81
	South Island.				
24	Westport	14·30	22	3·16	8·70
25	Greymouth	13·30	21	2·48	10·32
26	Hokitika	13·27	21	3·38	11·81
27	Ross	17·98	18	5·39	14·69
28	Arthur's Pass	16·04	12	5·93	20·93
29	Okuru	16·52	8	7·48	15·76
30	Bainham	9·56	20	3·99	15·82
31	Nelson	2·04	8	0·64	3·54
32	Spring Creek, Blenheim ..	0·78	15	0·16	2·63
33	Tophouse	4·12	14	1·46	5·68
34	Hanmer Springs	2·21	14	0·38	3·60
35	Highfield, Waiau	1·48	10	0·22	2·81
36	Gore Bay	1·51	13	0·40	2·20
37	Christchurch	1·01	16	0·19	1·70
38	Timaru	1·44	13	0 40	1·95
39	Lambrook Station, Fairlie ..	2·06	7	0·80	2·03
40	Benmore Station, Clearburn	1·60	11	0·54	2·15
41	Oamaru	2·47	12	0·61	1·74
42	Queenstown	1·74	12	0·52	3·45
43	Clyde	1·62	10	0·51	1·62
44	Dunedin	4·92	21	0·84	3·16
45	Wendon	3·70	15	0·75	2·81
46	Gore	..	..	..	3·28
47	Invercargill	4·59	22	0·76	4·56
48	Puysegur Point	10·98	25	2·07	8·13
49	Half-moon Bay	4·89	20	0·77	5·37

—*Edward Kidson, Director of Meteorological Services, Wellington, 6/11/30.*

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HORSE WITH BACK SORE.

"FARMER," Hawera :—

Kindly inform me how to cure a horse with a sore back caused by an ill-fitting saddle. The place swelled up and finally burst, and is now a sore about 1½ in. long, which I find very hard to heal.

The Live-stock Division :—

Without an examination of the animal it is rather difficult to locate the seat of the sore. If in the region of the withers a rather serious condition often results. This is known as fistulous withers, and is very difficult to treat successfully without a surgical operation. On the other hand, the sore may be an ordinary saddle-gall, which responds to treatment much more easily. First remove all pressure from the seat of the sore, either by discontinuing the use of the saddle or using a chambered saddle. Hot fomentations should be applied at frequent intervals to remove all pus and scab. It may be necessary to slightly cauterize the edges of the wound to stimulate healing. Cleanliness and the use of antiseptic solutions are necessary to assist recovery.

DEFICIENCY OF SOLIDS NOT FAT IN MILK.

"MILKY," Greenmeadows :—

I would be obliged if you could explain why milk is sometimes deficient in solids other than butterfat when the test is 4·4 per cent. and no water has been added. I had a sample of milk analysed, and it contained 5·4 per cent. of fat and 9·1 per cent. of other solids, while a neighbour with a lower test (5 per cent.) had a greater percentage of other solids (9·3 per cent.). In the case of milk containing less than the law allows of other solids, how could it be remedied ?

The Dairy Division :—

It is generally considered that, provided all other things are equal, any deficiency in the solids not fat in milk of 4·4 per cent. fat content or other percentage is to be attributed to characteristics inherent in the cow. These characteristics are to a large extent influenced by the individuality and breeding strain of the cow. Furthermore, solids not fat do not bear any set relation to the fat content. When the solids not fat in milk fall below the statutory requirements a way out of the difficulty is to mix the milk with some which is richer in solids not fat. In some cases this may possibly be effected by retaining for use on the farm a portion of the milking known to be poor in solids not fat. Relief can be got by feeding concentrates, but it is only of a temporary nature. Solids not fat may decline rapidly during brief periods of drought and recover on return of succulent green feed.

VARIATION IN CORE-COLOUR OF MAIZE.

J. F. ROLLEY, Marohemo :—

Would you kindly inform me as to the cause of white-cored maize appearing in a crop of maize the majority of which has red cores. Is it a different variety, or does the quality of the soil influence the shade or colour of the core ?

The Fields Division :—

Core-colour in maize shows a good deal of variation. With some exceptions, red or yellow varieties of maize have a red core, and white varieties a white core. In some varieties in which there has been remote or recent cross-fertilization

cores of mixed colour are to be found. A variety of maize with red cores may show up to 10 per cent. of white cores, even though red cores only have been selected for seed for many years. This may be caused by recent cross-fertilization, or by the fact that in the original red-cored stock the red characteristic was an impure dominant. The case you mention of white cores appearing in a crop the majority of which has red cores may be due either to the original red characteristic being impure or to recent cross-fertilization. The difference in colour is not connected with soil variations.

SMALL BIRDS AND SURFACE-SOWN GRASS-SEED.

K. A. McKENZIE, Martinborough :—

Can you tell me any method of preventing small birds from eating surface-sown grass-seed? The birds here are so numerous that out of about £20 worth of mixed seed I sowed last autumn in scattered patches of burnt scrub I am satisfied they did not leave a dozen seeds to the square yard. I tried turpentine on the seed, but it killed the seed, or a lot of it, and did not stop the birds. I should like to know about the red-lead method.

The Fields Division :—

It is extremely difficult to prevent small birds from eating grass-seed. Red-lead has been used as a prevention in connection with the depredation of turnip, rape, and clover seeds by birds, and is recognized by some as successful. The usual method is to mix sufficient red-lead dust with the seed to give a coating. The intention is to so obscure the seed that the birds do not recognize it, but it does not act as a poison and does not injure the seed. A treatment that has been found successful by some is as follows: Mix turpentine and kerosene in the proportion of 1 pint turpentine to 1 gallon of kerosene. When sowing, tip about ½ bushel of seed into the sowing-bag, then pour ½ pint or a little more of the mixture over the seed, stirring the latter well at the same time. The seed will not get sticky unless too much of the mixture is used.

PLOUGHING IN LUPINS BEFORE TURNIPS.

H. L. B., Ashburton :—

If advisable, I propose to plough in for green manure a paddock of blue lupins, and then drill turnips. As the lupins have only recently been drilled I do not expect them to be sufficiently advanced for ploughing under until about the middle of December. As the best time for drilling turnips in my locality is about the New Year, please advise whether you think this plan advisable. My soil is light and easily worked.

The Fields Division :—

To plough lupins under about the middle of December and follow with turnips at New Year would not be good practice. It is found that lupins, even under the best of conditions, take at least six weeks to decay, and in some soils much longer. We have seen turnips and beetroot sown on land into which lupins, and oats and vetches had been dug, but had not decayed; results were most unsatisfactory. Under your conditions of soil, if you can plough the lupins in about the beginning of December and follow about the second week in January with Hardy Green Globe turnips results will probably be satisfactory.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 83·19 per cent., compared with 87·56 per cent. last year. With 9,312,461 breeding-ewes in the North Island, as shown in the 1930 sheep returns, the number of lambs this season is estimated at 7,747,274. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 4th November, the figures being based on a card census: Wheat, 243,000 acres; oats, 322,000 acres; barley, 25,250 acres. The corresponding final totals for the preceding season (1929–30) were 238,653 acres of wheat, 282,814 acres of oats, and 18,631 acres of barley. Wheat, therefore, has an estimated increase in area this season of 4,347 acres, oats an increase of 39,186 acres, and barley an increase of 6,619 acres.

Also from a card census and at date 4th November the Statistician estimates this season's area under potatoes as 24,000 acres. The corresponding final figures for the 1929–30 season were 23,214 acres. Reckoned on the average of the last five seasons—5·56 tons per acre—the total yield from this season's area would be 133,500 tons, as compared with a total actual yield of 130,107 tons for 1929–30. Only holdings of 1 acre and over outside borough boundaries are covered by these figures; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs.

FERTILIZER IMPORTATIONS.

FOLLOWING are particulars of importations of fertilizers into New Zealand for the six months ended 30th September, 1930:—

Sulphate of ammonia: United Kingdom, 3,745 tons. *Cyanamide, nitrolim, &c:* Norway, 30 tons. *Nitrate of soda:* Chile, 754 tons. *Basic slag:* United Kingdom, 1,878 tons; Belgium, 17,437 tons; France, 10 tons; Germany, 4,641 tons; Luxemburg, 153 tons. *Bonedust:* India, 925 tons. *Guano:* United Kingdom, 10 tons; Seychelles, 7,915 tons. *Rock phosphate:* Nauru and Ocean Islands, 72,750 tons; Tuamotu Archipelago, 7,889 tons. *Phosphates (other):* United Kingdom, 1,135 tons; Belgium, 5,706 tons; France, 50 tons; Netherlands, 700 tons; Morocco, 717 tons. *Kainit:* France, 143 tons; Germany, 388 tons. *Muriate of potash:* France, 35 tons. *Sulphate of potash:* France, 400 tons; Germany, 531 tons. *Potash (other):* France, 1,525 tons; Germany, 2,408 tons. *Sulphate of iron:* United States, 1 ton. *Other fertilizers:* United Kingdom, 592 cwt.; Germany, 59 cwt.; Netherlands, 30 cwt.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 25th September to 6th November, 1930, include the following of agricultural interest:—

No. 62700: Milking-machine; F. A. Stempa, Invercargill, and others. No. 63432: Potato-grader; G. E. R. Kingsbury, Willowbridge. No. 63538: Apparatus for collecting grass-seed; D. A. Hawken, Maungatapere. No. 64387: Hay-sweep; S. Armstrong, Frankton Junction. No. 64498: Hay-sweep; E. C. Houchen, Hamilton. No. 65054: Swingletree-bar; H. V. Dyke, Auckland. No. 65486: Plough-lifting device; C. Stokell, Prebbleton. No. 63902: Manure-sower; J. B. Whisker, Netherton. No. 63915: Manure-distributor; J. Souter, Pongaroa. No. 63948: Hay-sweep; Booth, MacDonald, and Co., Ltd., Christchurch. No. 64137: Sheaf-elevator; J. H. Campbell, Balcairn. No. 63589: Manure-sower; Booth, MacDonald, and Co., Ltd., Christchurch. No. 63689: Milk or cream cooler: G. P. Dyer, Dunedin. No. 63768: Phosphatic product; W. C. Gentles, New Plymouth. No. 63868: Teat-cup inflation; F. J. Foote, Graham's Beach, via Onehunga. No. 62803: Teat-cup; D. F. Watson, Waitoa. No. 65062: Manure-distributor; A. Storrie, Auckland. No. 65243: Vacuum-tank for milking-machine; D. M. Wallace, Ltd., Te Aroha. No. 65671: Device for dosing animals; B. J. O'Donovan, Laggan, N.S.W., and others.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.